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WATER USE BY APPALACHIAN MANUFACTURERS 1964

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Prepared for
The Office of Appalachian Studies
Corps of Engineers

By the
Water Industries and Engineering Services Division
Business and Defense Services Administration
U.S. Department of Commerce

December 1967

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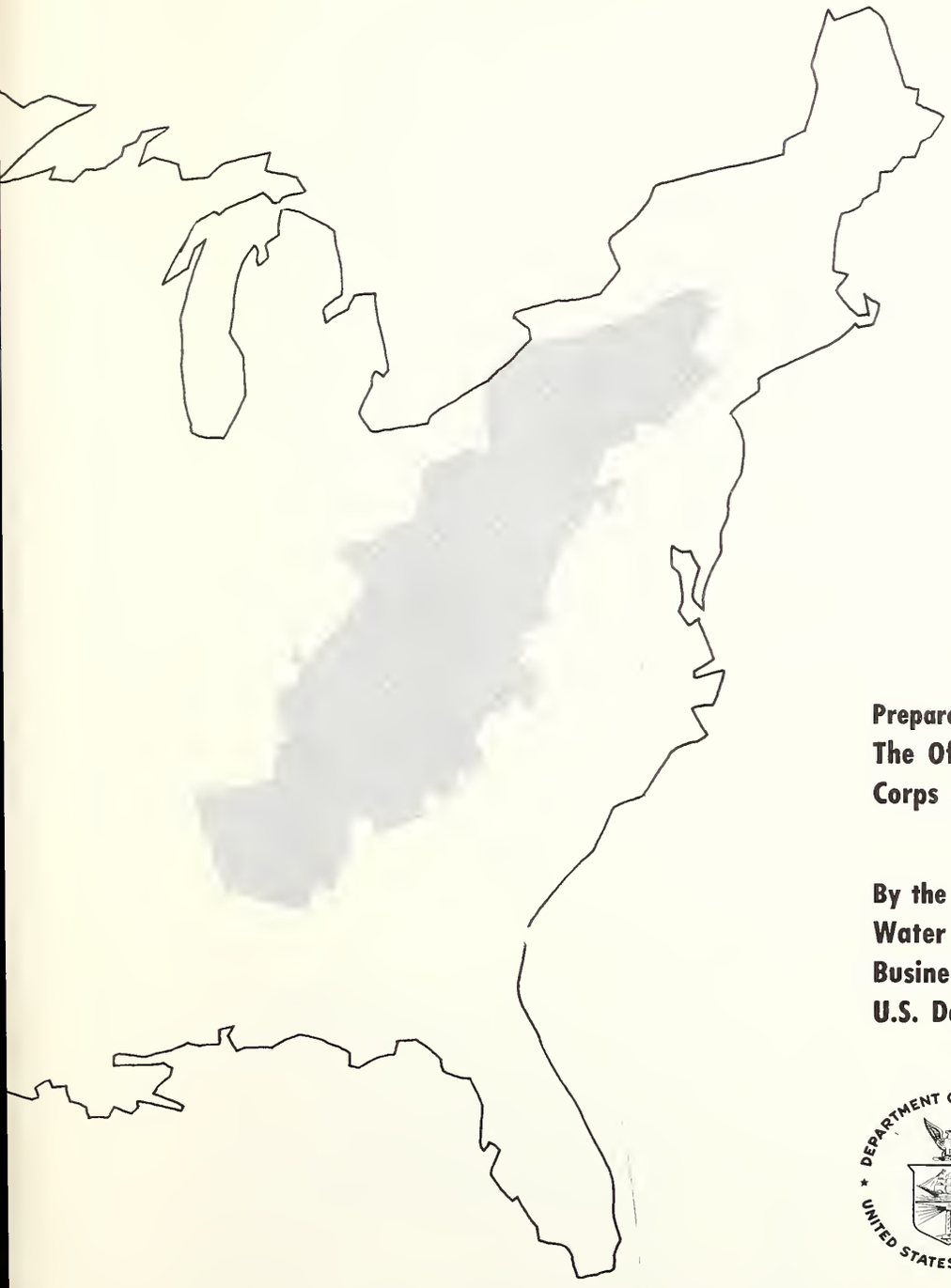

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Foreword

This study was performed by the Business and Defense Services Administration (BDSA), U. S. Department of Commerce, under contract with the U. S. Army Corps of Engineers, to report the use of water by industries in Appalachia and the relationship of that use to other economic factors.

The Appalachian region of this study consists of about 183,000 square miles of generally mountainous terrain extending southwesterly from the southern part of New York State to central Alabama and Georgia. It includes 373 counties located in portions of the States of New York, Pennsylvania, Ohio, Maryland, Virginia, North Carolina, South Carolina, Alabama, Georgia, Tennessee, Kentucky, and all of the State of West Virginia (see Appendix).

The scope of work involved the use of data from the *1964 Census of Manufacturers* from those manufacturing establishments which use more than 20 million gallons of water annually. Special extractions of data were made to permit comparisons of establishments within Appalachia with those in non-Appalachia conterminous United States. Other economic data for the same year and geographic areas, such as employment, value added, value of shipments, water conservation by reuse and recirculation were presented.

Technological trends were reviewed by Industry Divisions of BDSA and with individuals and industrial associations.

The study as presented includes charts, tables, and illustrations, plus pertinent statistics in an appendix.

The report was prepared under the general direction of K. L. Kollar, director, by Robert Brewer, branch chief, with the assistance of Joseph M. Conrad, commodity analyst, Water Industries and Engineering Services Division, BDSA.

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Summary

Manufacturing in Appalachia, as in the United States as a whole, is the largest sector of that region's economy. In 1964, there were 22,900 mills and factories in Appalachia employing 2,045,000 persons whose combined production exceeded $20 billion of value added by manufacture. Wages and salaries paid to those workers, $9.5 billion in 1962, constituted almost one-half of the total wages and salaries paid by all private employers of the region. Thus, Appalachia, with about 6 percent of the Nation's land area and 9 percent of its population, accounted for 10 percent of U.S. manufacturing production and 12.4 percent of U.S. manufacturing employment.

Most of the activities of this sector occur in the north central and southeastern counties of Appalachia in which the larger manufacturing establishments are located, with primary metals and chemicals industries concentrated in the North, and textiles and paper industries in the Southeast. Those four major industry groups provide more than one-third of the manufacturing jobs in Appalachia. In many of the counties in the central portion of the region, however, there is no manufacturing of major significance.

The average annual wages received by manufacturing employees and employee productivity in Appalachia are considerably lower than in non-Appalachia, with wages averaging about 84 percent and productivity about 76 percent of the non-Appalachia values. In large part, this is due to the considerable employment of unskilled and low-paid workers in the textile industry which tends to depress the averages for Appalachia, but in part it is due to the old and less efficient establishments into which little new capital is invested for new plant and equipment.

In 1964, the Bureau of Census reported 1,010 manufacturing establishments in Appalachia which were large users of water, with intakes of 20 million gallons or more annually. Together, those large water users withdrew 2,680 billion gallons, or 19 percent of the total withdrawn by all U.S. manufacturers. About one-third of the region's manufacturing employment, 745,000 employees, and nearly one-half of the value added by manufacture, $9.9 billion, resulted from the activities of this group of large water-using establishments.

Employee productivity in 1964, measured in value added per employee, was considerably higher in the large water-using group of Appalachian establishments than the average of its total manufacturing sector, $13,300 as compared to $9,780, but fell short of the $15,040 value added per employee of the large water-users in non-Appalachia. Value added per employee in Appalachia, however, is affected greatly by the low values in the textile industry group which average only $7,153 per worker. The large textile mills provided more than 15 percent of the employment in the large water-using manufacturing sector of Appalachia.

Six major industry groups comprised of 628 establishments accounted for 67 percent of employment and more than 97 percent of the water withdrawals by the large water-using manufacturing sector in Appalachia. The six industry groups are: SIC 22—Textile Mills; SIC 26—Paper and Allied Products; SIC 28—Chemicals; SIC 30—Rubber and Plastic Products; SIC 32—Stone, Clay, and Glass Products; and SIC 33—Primary Metals. These same six in non-Appalachia, although they were also large employers and users of water, accounted for only 32.5 percent of employment and 74 percent of water withdrawals.

A closer look at manufacturing water use in Appalachia reveals 21 SIC-4 digit industries to be major users. The 21 industries were selected by three criteria:

1. The total withdrawals of the industry were at least 3 billion gallons during 1964.
2. The average employment per industry establishment was at least 150 persons.
3. The total industry employment was at least 2,500 persons.

Comparisons between the same 21 industries in Appalachia and non-Appalachia revealed important structural differences in the large water-using manufacturing sectors of the two regions. For example, 67 percent of all U.S. plants for manufacturing cellulosic man-made fibers are found in Appalachia, as are 40 percent of the synthetic and cotton fiber weaving mills, and 39.5 percent of the steel mills. Appalachia, however, with its huge coal resources and proximity to petroleum fields,

has only 6.1 percent of the Nation's petroleum refining and coal products plants. Appalachia, a generally well-forested region, has no sawmills or planing mills that are large enough to require 20 million gallons of water annually.

Three quarters of the water taken in by Appalachian manufacturers, or 2,016 billion gallons in 1964, was used for cooling and condensing. About 25 percent of that quantity, 500 billion gallons, was used for cooling and condensing at company-owned steam electric generating plants, and the remainder was used for process cooling and other requirements. In non-Appalachia, proportionally less of the water intake was used for cooling and condensing, 64.9 percent, and a larger share was used in company-owned steam electric generating plants, about 33 percent of the cooling use. Although the differences in industry mix between the two regions may explain the proportionally smaller use for generating electricity at Appalachian plants, the availability of ample sources of power from public and private utilities in the manufacturing regions of Appalachia is believed to be the major reason.

Appalachian manufacturers, in general, appear to have been less conservative in their water use than their non-Appalachian counterparts. Non-Appalachian manufacturers, on the average, recirculated or reused their intake water 2.3 times compared to only 1.7 times in Appalachia. Of the 21 SIC 4-digit industries discussed earlier, only five Appalachian industries recirculated their intake water more than their non-Appalachian related industries. Water conservation in manufacturing is usually practiced in regions where water use is restricted by quantity or quality requirements. It is apparent that such restrictions were less severe in Appalachia.

Six SIC 4-digit industries were the subject of special study.

SIC 2015, Poultry and Small Game Dressing and Packing, is the largest user of water in the Food Industry Group in Appalachia. Small in terms of employment, SIC 2015 is a growing industry which appears to be well suited to Appalachia. Appalachian plants are larger and more efficient than those in other regions and are more conservative in their use of water. It is, however, a low-wage industry, with average employee earnings of $3,000 in 1964, and is low in terms of value added per employee.

SIC 2621, Paper Mills, a large user of water, is a rapidly growing industry in the United States, doubling its capacity about every 15 years. Appalachian establishments in this industry, although all at least 10 years old at the time of the 1964 Census, are larger plants than generally found in the United States, and are more productive. Although the industry as a whole is growing, Appalachia has not benefited from this growth in recent years, even though water, one of the major material needs of the industry, is available in volume in Appalachia.

SIC 2631, Paperboard Mills, although a large user of water, is a small industry in Appalachia, employing only 2,515 persons in 1964. Although the Appalachian plants are smaller than those of non-Appalachia, employee productivity is nearly 30 percent higher than in non-Appalachia, a contradiction to the general view of a direct relationship of plant size to efficient production. Water reuse by the Appalachian mills at 6.24 times is twice that of the non-Appalachian industry and reveals a considerable concern for water conservation, the reason for which is not known. In the United States as a whole, the demand for paperboard has been maintaining an annual growth rate of more than 5 percent with no signs of slackening. It may be anticipated that future expansion of the industry will occur in Appalachia.

SIC 2812, Alkalies and Chlorine, is represented by only six large water-using establishments in Appalachia which employed 3,895 persons in 1964. The plants, similar in size to those of non-Appalachia, enjoy about 25 percent higher employee productivity. This is believed to be the result of very high capital expenditures for new plant and equipment which, although increasing productivity, have resulted in a net decrease in employment. The industry is a very large user of water, withdrawing nearly 1,500 gallons of water per dollar of value added by manufacture. More than 97 percent of the water withdrawal is for cooling and condensing and, in most plants, is on a once-through basis, as is indicated by the overall recirculation ratio of only 1.10 for the industry.

SIC 2821, Plastic Materials and Synthetic Resins, in Appalachia consists of 16 large water-using establishments employing 7,975 persons in 1964. The output of plastics and synthetic resins has been increasing at a rate of almost 18 percent annually during the past ten years, making the industry one of the fastest growing in the manufacturing sector. About 30 new plants were constructed between 1963 and 1964. The variety of products produced is numerous and changing so rapidly that products and processes become obsolescent in 10 years or less, which necessitates continuing large expenditures for capital equipment and for research and development. The industry, a large user of water, is expected to continue its growth rate well into the next decade with employment increasing about 4.2 percent annually.

SIC 3312, Blast Furnaces and Steel Mills, is well represented in Appalachia with 108 establishments in operation during 1964. The industry is greatly concentrated in Pennsylvania where 66 plants are located, in Alabama with 14 plants, in Ohio with eight plants and in West Virginia, where there are seven. The Appalachian iron and steel industry is made up of comparatively old plants, but, although new plants have not been built in the region, plant modernization has kept the industry competitive under existing market conditions. Modernization has resulted in lower production costs but has reduced employment slightly in the Appalachian plants, a trend which may be expected to continue. Total employment by the Appalachian industry in 1964 is estimated at

182,500, of which 164,400 were employed by the 79 large water-using establishments. Total water withdrawals by this group were 1,114 billion gallons during 1964, or more than 41 percent of all water withdrawals by the Appalachian manufacturing sector. Reuse of water in Appalachia at a ratio of 1.44 times is similar to that practiced by the non-Appalachian industry, but it is expected that this ratio will increase considerably under the influence of pollution abatement programs.

Water is a major input in manufacturing, and the availability and cost of water is frequently a determining factor in the location of manufacturing establishments. Appalachia, with an average annual precipitation of 47 inches, is well-endowed with water resources. Although its steep, rugged slopes result in rapid runoff and occasional regional flooding, the construction of 102 reservoirs has provided storage capacity for 42 million acre-feet of water and has regulated the flows of many major streams. Other reservoirs proposed for construction will provide additional regulation. As a result of these regulatory structures, flood hazards are reduced, assured water supplies are available, and former flood plains are made suitable for commercial and industrial development. The large quantities of good quality water that are available can be utilized to further the industrial and economic development of the region.

CHAPTER I

The Availability of Water in Appalachia

Surface Water

With an average of 47 inches of annual precipitation, Appalachia's water resources are assured substantial replenishment. Although small areas in the highlands of North Carolina may receive as much as 80 inches annually, precipitation is generally well distributed throughout the region, ranging from 35 to 55 inches per year.

The mountain chain from which Appalachia gets its name induces high precipitation and forms a divide from which most of the streams that drain the region originate and flow into the Atlantic Ocean or Gulf of Mexico. With high elevations, water runoff is rapid and stream flows vary considerably between spring peak flows and the autumn lows. The total runoff, averaging 350 million gallons per square mile per year over the 183,000 square miles of land in the region, is equal to about 15 percent of the runoff of all America's streams. However, in common with much of non-Applachia, many streams lack means for flood water storage and protection. As a consequence, large quantities of runoff escape capture, and many plains, which border streams and are otherwise suitable for industrial and urban development, are subject to the hazards of floods.

At present, 102 reservoirs with a combined capacity of 42 million acre feet, or about one-fourth the annual stream flow have been constructed in Appalachia. Other reservoirs now under construction will raise the total storage capacity to more than one-third of the region's annual stream flow. The reservoirs, controlling floods, assuring water depths for navigation, storing water for hydroelectric power generation, and providing assured supplies of water for community and industrial development, are infrastructural changes that are basic to the orderly development of the region.

Surface Water Quality

In general, the quality of the surface water resources of Appalachia is good, although a few small areas exist where acid mine drainage, hardness, and domestic and industrial pollution reduce the usefulness of the waters. Most of the surface waters contain less than 300 parts per million (ppm) of total dissolved solids and may be classified as soft-to-moderately hard waters, on the basis of less than 100 ppm being soft water, from 100–300 ppm hard water, and over 300 ppm very hard water. Most of the hardness in Appalachia is due to calcium and magnesium sulfate, or permanent hardness, but is amenable to treatment.

The surface waters of the Blue Ridge and Piedmont provinces which comprise about 23 percent of the land area of Appalachia contain less than 50 ppm of dissolved solids, and are very soft waters. The streams which drain the limestone and dolomite areas of the Appalachian plateau and Appalachian mountains, constituting 42 percent of the Appalachian land area, contain between 50 and 300 ppm of dissolved solids. These are classified as soft-to-hard water streams. The hardness in this region is of the calcium and magnesium bicarbonate type or temporary hardness. In this plateau region, the streams of Kentucky, Tennessee, and Alabama are softer and less mineralized.

An additional 20 percent of the land area, that of the central plateau region, has surface waters of less than 150 ppm dissolved solids and calcium sulfate hardness.

In the coal mining regions which make up about 13 percent of Appalachia, streams are affected by acid mine drainage. Dissolved solids range from 100 ppm to 500 ppm, but occasionally may be as high as 2,000 ppm, with

hardness of the calcium sulfate type, high iron content, and very high acidity. Streams affected by acid mine drainage are generally unsuitable for industrial use without expensive treatment.

Several small areas, those drained by the Muskingum River in Ohio and the North Fork of the Holston River in Virginia and Tennessee, are affected by brines from petroleum and salt production facilities. In these streams, the dissolved solids, mostly sodium chloride, range from 100–1,300 ppm and on occasions may reach 5,000 ppm.

In most of Appalachia there is an abundance of surface water available, about 85 percent of which can be used by industry with only conventional treatment before use.

Groundwater and Its Quality

The most productive aquifers (100 to 3,000 gallons per minute, gpm) are located in the valleys of northern Pennsylvania and along the Alleghany and Ohio Rivers. While there are some other favorable areas of abundant groundwater supplies, small-to-moderate sources are available almost throughout the area. Generally, the Blue Ridge and Piedmont provinces are least productive. The Valley and Ridge province with moderate production contains limestone areas.

Although the quality of groundwater in Appalachia is generally satisfactory for most uses, iron content and hardness could be troublesome for industrial uses.

CHAPTER II

Manufacturing and the U.S. Economy

Manufacturing is the largest sector of the Nation's economy. Income originating in manufacturing has averaged 30 percent of national income over the past 40 years, and is nearly twice as large as the next largest sector, Wholesale and Retail Trade. In 1963, nearly 17 million of the total civilian labor force of 75 million were employed in manufacturing whose total value of shipments exceeded $420 billion. Wages and salaries paid by manufacturers, $93.3 billion, provided an average employee income of $5,745 in 1963, well above the average earnings of employees in most other sectors. Manufacturing activity and the state of the Nation's economy, as measured by gross national product, are closely related. This is evident in the date presented in Table 1 where the dip and rise in manufacturing production is paralleled by GNP.

Manufacturing capacity has increased at an average annual rate of about 5 percent during the 11-year period covered in the table, somewhat exceeding growth in demand which has permitted the demand to be met without utilizing the full industrial capacity. In addition to the increased production made possible by enlarged capacity, however, gains have also resulted from increased worker productivity as is evident from the static level of manufacturing employment.

About 315,000 establishments make up the manufacturing sector, but most are small in terms of employment, manufacturing output, capital expenditures, and market area. Over 200,000 of the establishments employ fewer than 20 persons each, account for only 6.5 percent of value added by manufacture, and less than 8 percent of manufacturing employment.

Most manufacturing takes place in the States which lie east of the Mississippi River. Chart 1, *Industrial Counties of the United States*, 1963, illustrates the heavy concentration in those States. More than 70 percent of U.S. manufacturing establishments and more than 75 percent of the national product originating in manufacturing are found in that region. The outline of Appalachia is inscribed on the chart, and, although not intended to show quantitatively the lessor role of manufacturing in Appalachia in comparison with other Eastern States, it does point out the preponderance of those activities in the non-Appalachian Eastern States.

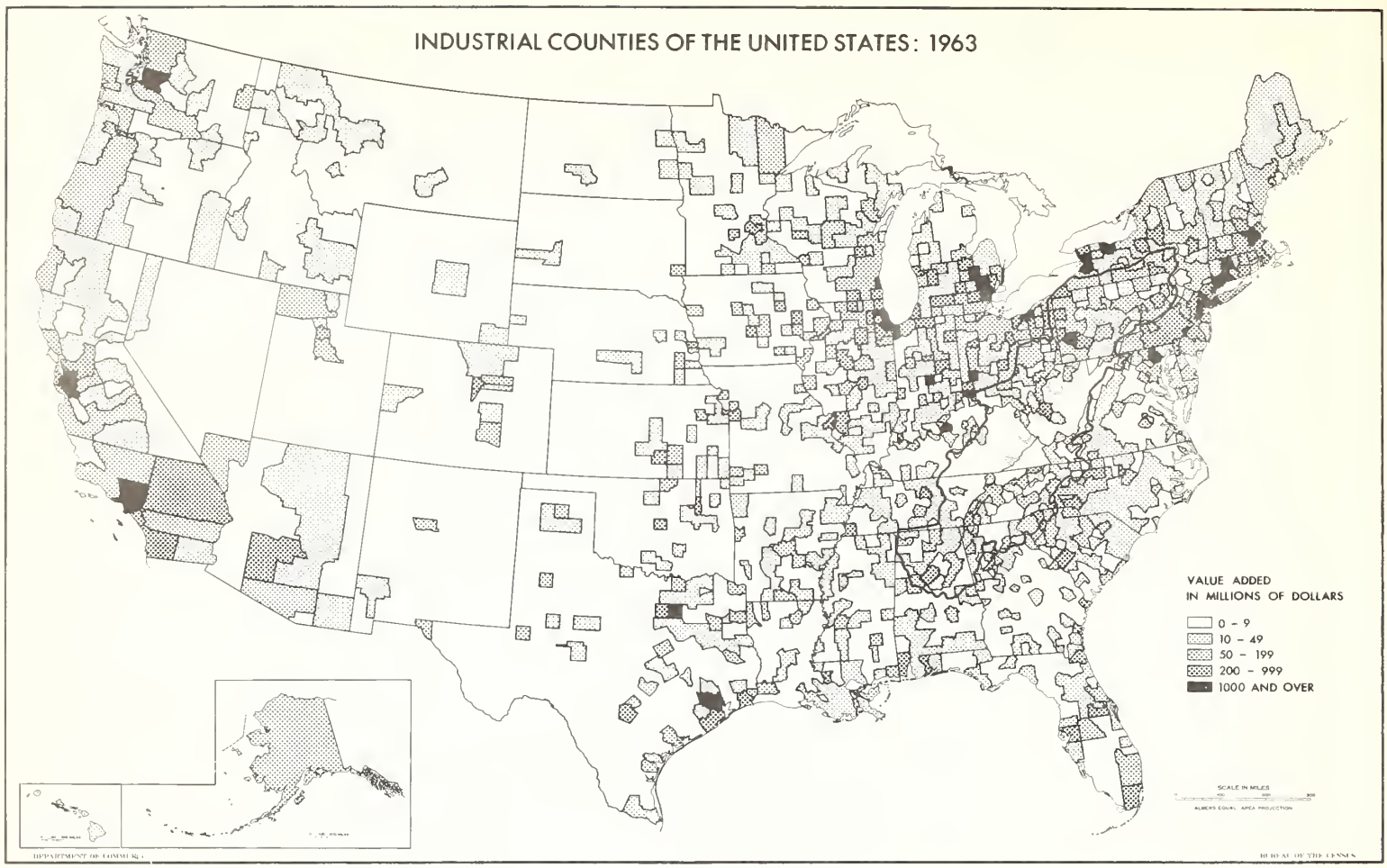
In recent years, shifts in new plant locations have been occurring, not only because of population shifts, but also in response to other economic factors, such as sources of raw materials, new markets, availability of labor, local labor laws, tax incentives, and the greater cost of expanding operations in the older industrial areas. In table

Table 1.—General Economic Data Related to U.S. Manufacturing

	1953	1954	1958	1959	1963	1964
Gross national product in billions of dollars	364.6	364.8	447.3	483.7	590.5	631.7
Total industrial production index [1957–59=100]	91.3	85.8	93.7	105.6	124.3	132.3
Total manufacturing production index [1957–59=100]	92.7	86.3	93.2	106.0	124.9	133.1
Number of manufacturing establishments (number)	285,000	286,814	298,182	N/A	306,617	311,784
Value added by manufacturing establishments ($1,000)	121,659,136[1]	117,032,326	141,270,297	161,535,876	192,103,102	205,963,000
All employees, manufacturing (number)	16,693,076	15,645,491	15,393,766	16,062,862	16,234,506	16,497,320
Production workers manufacturing (number)	13,500,934	12,372,002	11,644,213	12,272,622	12,232,041	12,431,000
Manufacturing capacity[2]	99	104	126	130	149	155
Utilization rate (percent)[2]	94	83	74	82	84	86
Total water use in manufacturing[3] in billions of gallons:						
Intake		11,570		12,131		14,045
Gross water use		21,042		26,257		30,599
Water discharged		10,789		11,445		13,157

[1] Unadjusted.
[2] Source, Economic Report of the President, 1967, Page 253.
[3] Establishments reporting use of 20 million gallons or more a year.

Chart 1



2, the movement of industry into the South and West may be noted.

In addition to the employment provided by manufacturing, other benefits accrue in the regions where plants are located. Capital expenditures for new plant and equipment are large and such expenditures increase tax bases upon which local governments can plan and execute programs for the general welfare. These benefits prompt communities to actively seek new industries, and those which have large reserves of good quality water emphasize this as an attraction to industries with large requirements for water. It is perhaps more than coincidental that most new plants for the manufacture of pulp, paper, and paperboard have been located in the southeastern states which have large quantities of water available.

Table 2.—Distribution of Value Added by Manufacture, Adjusted, by Census Regions: 1953, 1958 and 1963

Census regions	1953		1958		1963	
	Value added ($ millions)	Percent	Value added ($ millions)	Percent	Value added ($ millions)	Percent
United States total	$121,659	100.0	$141,541	100.0	$192,103	100.0
New England	9,905	8.1	10,440	7.4	13,589	7.1
Middle Atlantic	31,655	26.0	34,814	24.6	43,560	22.7
East North Central	39,926	32.8	40,962	28.9	56,326	29.3
West North Central	7,050	6.0	8,870	6.3	11,809	6.1
South Atlantic	10,686	8.8	14,355	10.1	21,134	11.0
East South Central	4,667	3.8	6,389	4.5	9,383	4.9
West South Central	5,647	4.6	7,791	5.5	10,942	5.7
Mountain	1,502	1.2	2,244	1.6	3,472	1.8
Pacific	10,621	8.7	15,666	11.1	22,112	11.5

CHAPTER III

Water Use in U.S. Manufacturing

Although the United States has been conducting censuses of manufacturers since 1809, the reporting of water use by manufacturing establishments has been included only in the last three quinquennial censuses. The most recent of these, the *1963 Census of Manufacturers,* covered 311,784 establishments with one or more employees and required those that employed six or more to mark check-boxes which stated their annual water intake in five ranges.

Table 3.—Number of Establishments Reporting Annual Water Intakes, 1963

Total	Under one mil. gal.	1–9 mil. gal.	10–19 mil. gal.	20–99 mil. gal.	100 mil. gal. and over
130,294	96,181	18,904	4,629	5,996	4,584

Those establishments which estimated their water intake to be 20 million gallons or more annually were required to provide detailed information on their water use in a special canvass made by the Bureau of Census in the year following the census of manufactures. The responses to the canvass provide detailed information on volume of water intake, source of water, in-plant use, recirculation, treatment methods, volume of discharge, and points of discharge. This canvass, for the year 1964, is reported in the U.S. Department of Commerce publication (MC63(1)–10), *Water Use in Manufacturing.* For the purpose of this report on *Water Use by Appalachian Manufacturers,* a special extraction from that data on the large water-using establishments in Appalachia was made. Data for Appalachia in earlier years was not obtainable.

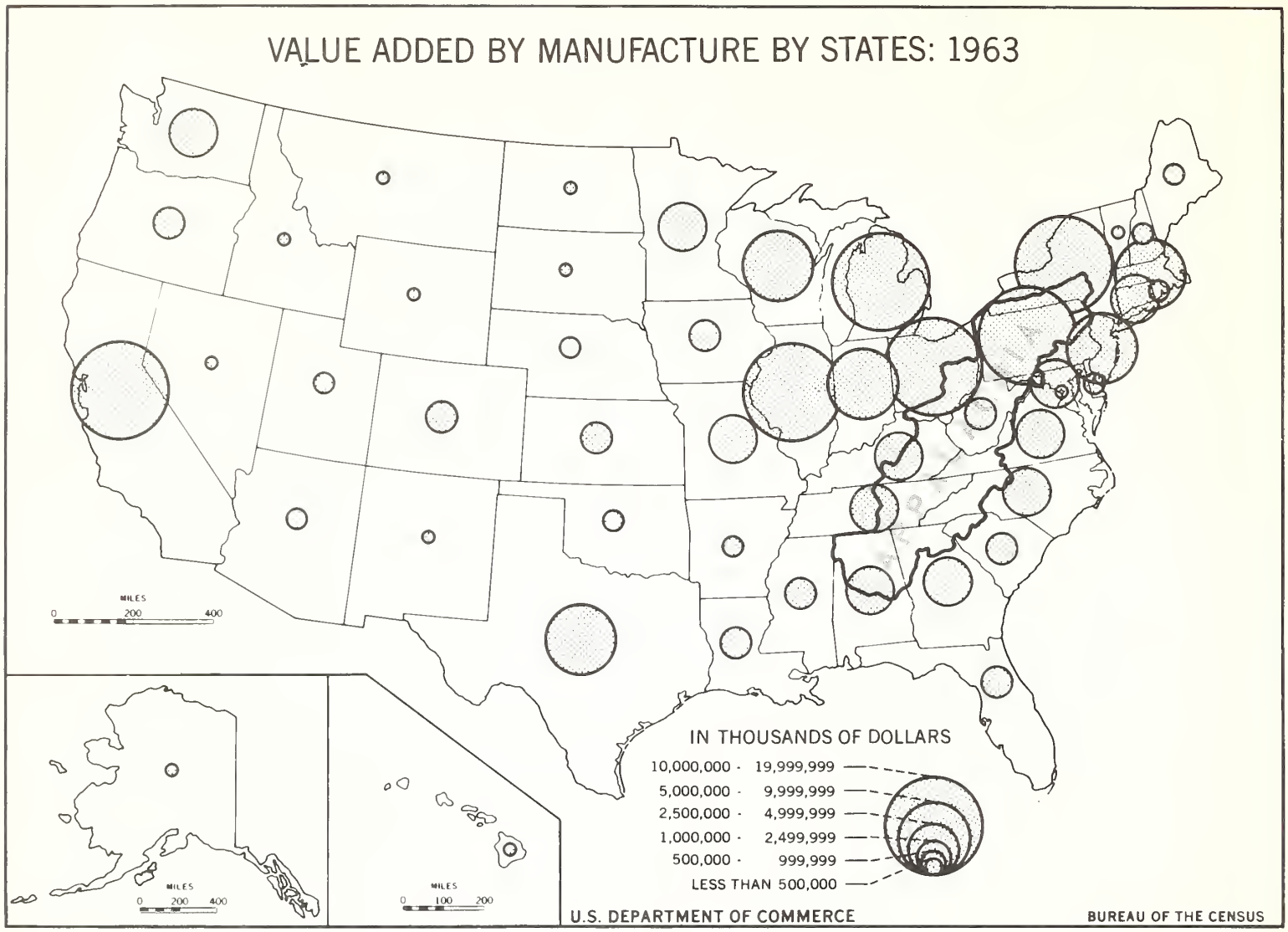
In the 1964 special canvass, 8,925 U.S. manufacturers reported actual water intakes of 20 million gallons or more annually. These large water-using establishments withdrew 14,045 billion gallons, while all other manufacturing establishments together are estimated to have required only 400 billion gallons during the same year. The processing of the materials and products of manufacture required 3.7 trillion gallons, and about one trillion gallons were used for boiler feed, sanitary services and other uses. The remainder of the intake was used for cooling and condensing. More than 20 percent of the input was brackish water, used mostly as a coolant, but withdrawn by some industries as a raw material for extraction of basic chemicals and metals.

Slightly less than 10 percent of the fresh water was purchased from public water systems. For its self-supplied fresh water, the manufacturers withdraw 8.5 trillion gallons from surface sources and 1.4 trillion gallons from wells. About 1.0 trillion gallons was consumed through incorporation of the water into product, evaporation, and unaccounted losses. The remaining 13.2 trillion gallons, the plant effluents, were returned to surface water bodies (11.8 trillion gallons), to public sewers (1.0 trillion gallons), to the ground (0.20 trillion gallons), and to other users (0.22 trillion gallons). Some 3.8 trillion gallons received treatment before discharge.

The large water users, representing less than 3 percent of all manufacturing establishments, accounted for more than 46 percent of the total value added by manufacturing ($94.7 billion out of $206 billion) and provided 38.8 percent of employment in manufacturing (6.4 million persons out of 16.5 million).

Chart 2, *Value Added by Manufacture,* illustrates the large contribution of manufacturing production in the states which lie east of the Mississippi River. As would be expected, water use is correspondingly high. Seventy-five percent of the Nation's withdrawals of water for manufacturing occurs in that region. In addition, a concentration of the Nation's large water-using industries is also found there. Ninety percent of the establishments in the Primary Metals group of industries (Standard Industrial Classification–33) are located east of the Mississippi River (96 percent of U.S. steel production

Chart 2



occurs there), and this industry group alone uses 32.7 percent of the water withdrawn for all U.S. manufacturing. In the eastern third of the Nation, this group of industries accounts for 36 percent of manufacturing withdrawals. Of the other three major water-using industry groups, the concentration in states east of the Mississippi River in terms of percentage of total establishments is: Paper and Allied Products (SIC–26)—75.7 percent, Chemicals and Allied products (SIC 28)—63.7 percent, and Petroleum and Coal Products (SIC 29)—55.9 percent.

In general, manufacturing plants with large requirements for water are large establishments with a high degree of automation, strict quality control, a large annual or seasonal production schedule, and a need for skilled workers. As a result, productivity, measured in terms of value added in manufacture per employee is greater in the large water-using industries than the average for all manufacturing industries. Both have been increasing, but the rate of increase is greater in the large water-using group.

Table 4.—Productivity Related to Water Use

Year	(1) All establishments value added/employee	(2) Large water users value added/employee	$\frac{(1)}{(2)} \times 100$
1960	$10,143	$11,298	96.0
1964	12,484	14,800	93.7

Employee income also is greater in the large water-using industries. In 1964, the average yearly earnings of employees in the large water-using establishments was $7,710, while the average in all other establishments was only $5,130.

The Standard Industrial Classification System categorizes manufacturing activities into 425 SIC 4-digit industries, each comprised of establishments which produce the same or similar lines of products, and employ similar processes and raw materials. Not all have establishments

with large water requirements. In the Census of Manufactures, only 187 SIC 4-digit industries were represented among the establishments reporting water intakes of 20 million gallons or more per year. Even in this selected group of industries, a smaller number stand out as large water users. Table 5 lists the 30 major water-using industries in the United States. Their significance in the national economy is evident.

Table 5.—Economic Data for Selected Large Water-Using 4-Digit SIC Industries

(United States as a Whole)

(1964 Data)

SIC Code	Industry name	No. of estab.	Intake water (billion gallons)	Gross water used (billion gallons)	Value added ($ million)	Employment
2011	Meat Slaughtering Plants	237	84	138	1,249	114,444
2061	Raw Cane Sugar	46	123	252	99	6,661
2063	Beet Sugar	58	54	86	196	11,061
2082	Malt Liquors	119	59	94	1,189	56,835
2211	Weaving Mills, Cotton	123	27	87	788	127,850
2421	Sawmills and Planing Mills	93	113	157	279	36,051
2611	Pulp Mills	34	279	892	255	12,994
2621	Paper Mills, Except Building	271	1,138	3,095	1,736	120,447
2631	Paperboard Mills	183	577	1,845	1,098	56,696
2661	Building Paper and Board Mills	45	31	76	127	9,393
2812	Alkalies and Chlorine	31	528	628	381	19,090
2815	Intermediate Coal Tar Products	56	108	277	514	23,105
2818	Organic Chemicals, N.E.C.[1]	139	1,708	3,319	2,394	75,385
2819	Inorganic Chemicals, N.E.C.[1]	188	499	1,312	1,541	67,759
2821	Plastics Materials and Resins	114	218	470	1,120	49,839
2822	Synthetic Rubber	24	61	182	330	11,840
2823	Cellulose Man-Made Fibers	18	152	233	356	27,222
2824	Organic Fibers, Noncellulose	20	98	208	896	40,976
2834	Pharmaceutical Preparations	55	28	79	2,089	58,107
2861	Gum and Wood Chemicals	18	26	117	77	4,115
2871	Fertilizers	59	113	217	176	10,028
2911	Petroleum Refining	214	1,388	6,146	2,942	111,644
3011	Tires and Inner Tubes	51	60	173	1,266	80,320
3069	Rubber Products, N.E.C.[1]	115	70	105	885	81,023
3241	Cement, Hydraulic	145	114	151	660	29,410
3312	Blast Furnaces and Steel Mills	200	3,815	5,510	7,175	481,867
3331	Primary Copper	21	32	161	213	9,337
3334	Primary Aluminum	20	197	335	470	17,189
3717	Motor Vehicles and Parts	237	125	395	10,866	541,173
3722	Aircraft Engines and Parts	36	60	108	1,633	138,944
	Totals	2,970	11,885	26,848	43,000	2,430,805
	All U.S. large water-using industries	8,925	14,045	30,599	94,706	6,396,906

[1] — Not Elsewhere Classified.

CHAPTER IV

Manufacturing in Appalachia

Although Appalachia has been the subject of many studies in recent years, it is difficult to relate the data and findings of the studies to the use of water by manufacturers. The difficulty arises from differences in definition of terms, base years, and methods of satistical analysis, lack of historical data, and the varying bounaries of the Appalachia under study. In this report, the Bureau of Census, Censuses of Manufactures and canvasses of Water Use in Manufacturing provide the basic data. Where other sources of data are used, such as the Office of Business Economics and Appalachian Regional Commission, factors have been employed, when possible, to provide comparability with Census data.

Manufacturing in Appalachia, as in the United States as a whole, is that region's largest economic sector. In 1962, wages and salaries paid by manufacturers amounted to $9.5 billion, or about one-half of the total wages and salaries of $21.9 billion paid by all private employers. In 1963, there were 22,808 manufacturing establishments in Appalachia employing a total of about 2,020,000 persons, or about 12.4 percent of all U.S. manufacturing employment. Output of those plants, measured by value added in manufacture, was $19.75 billion or about 10.3 percent of the U.S. total.

Average annual wages and value added per employee in the Appalachian manufacturing sector are lower than the averages for the non-Appalachian sector and U.S. manufacturing as a whole.

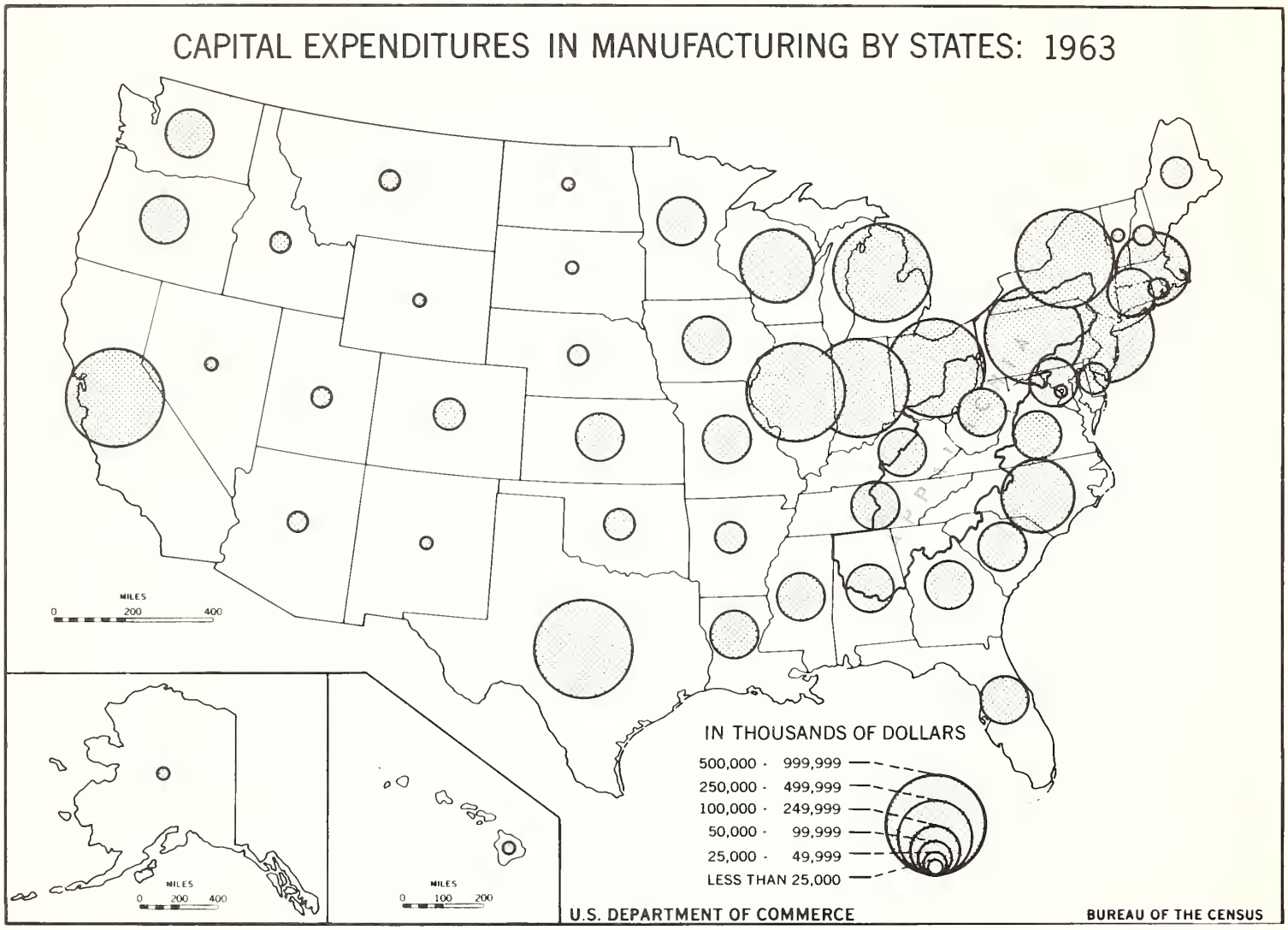
In part, the lower average annual earnings of Appalachian workers result from the large employment of unskilled and low-paid workers in textile mills and plants, leather tanning and processing establishments, and in food processing establishments. The lower average employee productivity, measured in value added, also may be explained by the presence of those same industries which are labor intensive rather than capital intensive.

Table 6.—Average Annual Wages and Employee Productivity

	Average annual wages per manufacturing employee (1962)	Average annual value added per manufacturing employee (1964)
Appalachia	$4,750	$ 9,780
Total United States	5,575	12,480
Non-Appalachia	5,670	12,870

Capital expenditures for new plant and equipment are lower in Appalachia than non-Appalachia in all but a few industries, and this too provides explanation, in part, for the lower employee productivity in the area. (see chart 3). For example, in West Virginia, which is totally in the Appalachian region, new capital expenditures per manufacturing employee in 1958 and 1963 were $1,478 and $1,479, respectively. This is much higher than the overall U.S. average of $619 and $700 during the same years. However, the greatest part of the West Virginia expenditures were made in SIC 28 and SIC 33 industries both of which have shown declines in employment. Subtracting the capital expenditures and employment figures for those industries from the state and national totals, the investment per employee in new and presumably more efficient plants and equipment in West Virginia becomes $395 and $312 for years 1958 and 1963, respectively, compared to $496 and $584 for the United States as a whole.

Chart 3


CAPITAL EXPENDITURES IN MANUFACTURING BY STATES: 1963
MILES
0 200 400
IN THOUSANDS OF DOLLARS
500,000 - 999,999
250,000 - 499,999
100,000 - 249,999
50,000 - 99,999
25,000 - 49,999
LESS THAN 25,000
MILES
0 200 400
MILES
0 100 200
U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

CHAPTER V

Water Use by Appalachian Manufacturers

For this study, the data on water use by manufacturers obtained by the Bureau of Census in the 1964 canvass of water use was processed to segregate the information on large water-using establishments according to their location in Appalachia or non-Appalachia. The appendix to this report contains that information presented in tabular format similar to that used in the national reporting.

Legislative restrictions against the publication of Census information in detail that would reveal data on individual company operations have made it necessary to group a number of 4-digit SIC industries into broader and less revealing 3-digit or 2-digit industry groupings. As a consequence, only 39 SIC 4-digit industries are found in the Appalachia tables. A few more 4-digit industries are included in the non-Appalachia tables, but the additional industries found in these latter tables represent manufacturing establishment that were not present in Appalachia, or if present, were not large enough to require water withdrawals of 20 million gallons or more during 1964.

There were about 22,900 manufacturing establishments in Appalachia in 1964, of which 1,010 were large water users. Total manufacturing employment was about 2,045,000, with about 754,000 employed by industries with large water requirements. Appalachian industries in 1964 withdrew 2,680 billion gallons of water, or 19 percent of the total withdrawn by all U.S. manufacturers. Nearly one-half or the region's value added by manufacture, $9.5 billion, and more than one-third of its manufacturing employment, 745,000 persons resulted from the activities of its large water-using manufacturing establishments.

Table 7 reveals that a smaller percentage of total Appalachian manufacturing employment was provided by its large water-using industries, and productivity per employee was lower. Less employment resulted per unit quantity of water withdrawn, and value added per unit quantity of water also was less in Appalachia. Part of the explanation for these differences may be found in the degree of concentration of certain industries in Appalachia. This is supported by the fact that 97.1 percent of all water withdrawn for manufacturing is used by 6 industry groups. The 6, SIC 22, Textile Mills, SIC 26 Paper and Allied Products, SIC 28 Chemicals, SIC 30 Rubber and Plastic Products, SIC 32 Stone, Clay and Glass Products, and SIC 33 Primary Metals are also the big employers and large producers of goods in the region, accounting for 67.4 percent of the employment in all large water-using establishments and 68 percent of their total value added in manufacture.

By contrast, in non-Appalachia, the same industry groups constitute a smaller proportion of that region's manufacturing sector. In non-Appalachia the six industry groups account for only 74 percent of manufacturing withdrawals, employ 32.5 percent of the workers in all large water-using industries and account for only 35 percent of their value added in manufacture.

Table 7.—Manufacturing Employment and Productivity
Appalachia, Total U.S., Non-Appalachian U.S.

(1964 Data)

	Appalachia	Non-Appalachian U.S.	Total U.S.
Total employment in manufacturing establishments	2,045,000	14,452,000	16,497,000
Employment in large water-using establishments*	744,607	5,652,299	6,396,906
Percent employed in large water-using establishments*	36.4	39.1	38.8
$ Value added/employee all establishments	9,780	12,870	12,480
$ Value added/employee large water-using establishments	13,300	15,040	14,800
Employees/M.G.[1]—large water-using establishments*	0.27	0.50	0.46
$ Value added/M.G.—large water-using establishments*	3,691	7,510	6,779

* Those establishments reporting water intake of 20 million gallons or more a year.
[1] Million gallons of intake water.

Tables 8 and 9 present a closer view of the industry mix of the large water users in Appalachia and non-Appalachia. The industries listed were selected from among the 39, 4-digit SIC industries of Appalachia reported in the Bureau of Census tables. Selection of the industries was based on three criteria:

1. That the total water withdrawals of the industry were at least 3 billion gallons.
2. That the average establishment in the industry employed at least 150 persons
3. And, that the total employment in the industry was at least 2,500 persons.

Included in the tables are four 3–digit industry aggregates and one 2–digit industry group, which are considered to be important manufacturing activities, but for which 4-digit SIC industry information was not available.

Comparing tables 8 and 9, the structural differences between the large water-using manufacturing sectors of Appalachia and non-Appalachia are revealed. For example, 67 percent of all U.S. plants for manufacturing cellulosic man-made fibers are found in Appalachia, as are 40 percent of the synthetic fiber, and cotton weaving mills, and 39.5 percent of the steel mills. Surprisingly, although Appalachia is a coal producing region and borders on petroleum fields, only 6.1 percent of the Nation's petroleum refining and coal products plants are located there. Also, with all of its forest lands, Appalachia has no sawmills or planing mills that are large enough to require 20 million gallons of water a year. In general, then, the Appalachian large water-using manufacturing sector is less diversified than that of non-Appalachia and is strongly dominated by a few industries.

A set of physical and economic relationships have been developed for the Appalachian and non-Appalachian industries listed in the following two tables by which the influences of the industries on their region can be measured and comparisions made between regions. These relationships may also be used by regional planners to estimate, for particular industries, the employment and gross regional product that may result from water inputs to each industry.

Table 10 shows the percentages of the U.S. totals of establishments in each of the significant large water-using industries located in Appalachia in 1964. Unfortunately, due to lack of similar information for earlier years, trends in the concentration of these manufacturing activities in the Appalachian region are not known. The 1964 data, however, established a bench mark from which the direction and degree of future trends can be observed.

Table 8.—Economic Data for Selected Large Water-Using 3 and 4-Digit SIC Industries

(Appalachia)

(1964 Data)

SIC Code	Industry name	No. of estab.	Intake water (billion gallons)	Gross water used (billion gallons)	Value added ($ million)	Employment
201*	Meat products	32	4	4	49	7,371
2015	Poultry Dressing	22	3	3	34	5,686
2211	Broad Woven Fabric—Cotton	48	8	33	245	41,577
2221	Broad Woven Fabric—Synthetic	28	4	15	171	22,782
2261	Textile Finishing—Cotton	10	6	7	39	5,090
2621	Paper, Except Building Paper	18	183	800	270	18,584
2631	Paper Board	16	17	106	63	2,515
2812	Alkalies and Chlorine	6	128	140	90	3,895
2815	Dyes and Cyclic Intermediates	11	7	24	88	2,873
2818	Organic Chemicals, N.E.C.[1]	17	392	413	559	14,067
2819	Inorganic Chemicals, N.E.C.[1]	15	87	185	248	10,291
2821	Plastic Materials	16	55	70	199	7,975
2823	Cellulose Man-Made Fibers	12	111	170	264	20,436
283*	Drugs	5	7	9	89	3,265
289*	Other Chemical Products	12	33	34	71	3,996
2911	Petroleum Refining	13	22	77	45	3,115
30*	Rubber and Plastic Products	33	47	88	233	16,585
3079	Plastic Products, N.E.C.[1]	16	3	4	47	3,832
3111	Leather Tanning and Finishing	18	5	5	30	3,363
3229	Pressed and Blown Glass	11	4	9	120	8,287
3241	Cement, Hydraulic	21	8	10	89	3,946
3312	Blast Furnaces	79	1,114	1,609	2,216	164,423
3317	Steel Pipe and Tubes	5	4	5	40	2,985
3321	Gray Iron Foundries	15	4	6	99	11,251
333*	Primary Non-Ferrous Metals	7	32	39	125	6,750
3352	Aluminum Rolling and Drawing	9	4	36	136	12,047
	Totals (Excluding SIC 201 and 30)	430	2,241	3,809	5,409	383,031
	All Appalachian large water-using industries	1,010	2,686	4,468	9,914	744,607

* 4-Digit SIC industry data is not available.
[1]—Not elsewhere classified.

Table 9.—Economic Data for Selected Large Water-Using 3 and 4-Digit SIC Industries

(Non-Appalachian United States)

(1964 Data)

SIC Code	Industry name	No. of estab.	Intake water (billion gallons)	Gross water used (billion gallons)	Value added ($ million)	Employment
201*	Meat Products	411	102	161	1,555	153,274
2015	Poultry Dressing	132	14	16	141	26,246
2211	Broad Woven Fabric—Cotton	75	19	54	542	86,273
2221	Broad Woven Fabric—Synthetic	42	6	11	194	24,968
2261	Textile Finishing—Cotton	48	31	37	210	25,567
2621	Paper, Except Building Paper	253	955	2,295	1,466	101,863
2631	Paper Board	167	560	1,739	1,035	54,181
2812	Alkalies and Chlorine	25	400	487	291	15,195
2815	Dyes and Cyclic Intermediates	45	100	252	426	20,232
2818	Organic Chemicals, N.E.C.[1]	122	1,316	2,905	1,834	61,318
2819	Inorganic Chemicals, N.E.C.[1]	173	412	1,127	1,293	57,468
2821	Plastic Materials	99	163	401	923	41,863
2823	Cellulose Man-Made Fibers	6	41	63	92	6,786
283*	Drugs	67	58	112	2,125	62,629
289*	Other Chemical Products	98	61	104	465	23,835
2911	Petroleum Refining	201	1,365	6,084	2,897	108,529
30*	Rubber and Plastic Products	248	116	248	2,434	193,818
3079	Plastic Products, N.E.C.[1]	86	25	48	305	27,314
3111	Leather Tanning and Finishing	63	11	13	138	14,912
3229	Pressed and Blown Glass	26	5	23	235	17,735
3241	Cement, Hydraulic	124	106	141	570	25,464
3312	Blast Furnaces	121	2,700	3,901	4,959	317,444
3317	Steel Pipe and Tubes	20	8	13	115	9,107
3321	Gray Iron Foundries	54	16	24	434	39,914
333*	Primary Non-Ferrous Metals	64	354	665	775	35,304
3352	Aluminum Rolling and Drawing	32	19	28	273	23,335
	Totals (Excluding SIC 201 and 30)	2,143	8,745	20,543	21,738	1,227,482
	All non-Appalachian large water-using industries	7,915	11,360	26,130	85,310	5,671,734

* 4-Digit SIC Industry data is not available.
[1]—Not elsewhere classified.

Table 10.—Significant Measurements and Comparisons of Water Related Factors for Selected Large Water-Using Industries (Appalachia and Non-Appalachia)

(1964 Data)

SIC Code	Industry name	Percent U.S. estab. in Appal.	Average No. employees per estab.		Dollars value added/ employee		Dollars value added/ m.g. intake		Employees/ m.g. intake		Water recirculation rate [1]	
			Appal.	Non-Appal.	Appal.	Non-Appal.	Appal.	Non-Appal.	Appal.	Non-Appal.	Appal.	Non-Appal.
201	Meat Products	7.2	230	372	6,647	10,145	12,250	15,245	1.84	1.50	1.00	1.58
2015	Poultry Dressing	14.3	258	197	5,979	5,372	11,333	10,071	1.90	1.87	1.00	1.14
2211	Broad Woven Fabric—Cotton	39.0	866	1,150	5,892	6,282	30,625	28,526	5.20	4.54	4.12	2.84
2221	Broad Woven Fabric—Synthetic	40.0	813	594	7,505	7,769	42,750	32,333	5.70	4.16	3.75	1.83
2261	Textile Finishing—Cotton	17.2	509	532	7,662	8,213	6,500	6,774	0.85	0.82	1.17	1.19
2621	Paper, Except Building Paper	6.6	1,032	402	14,528	14,391	1,475	1,535	0.10	0.11	4.37	2.40
2631	Paper Board	8.7	157	324	25,049	19,102	3,706	1,848	0.15	0.10	6.24	3.10
2812	Alkalies and Chlorine	19.4	649	607	23,106	19,151	703	728	0.03	0.04	1.09	1.22
2815	Dyes and Cyclic Intermediates	19.6	261	449	30,630	21,055	12,571	4,260	0.41	0.20	3.43	2.52
2818	Organic Chemicals, N.E.C.[2]	12.2	827	502	39,738	29,909	1,426	1,393	0.04	0.05	1.05	2.21
2819	Inorganic Chemicals, N.E.C.[2]	8.0	686	332	24,090	24,499	2,851	3,138	0.12	0.13	2.13	2.74
2821	Plastic Materials	13.9	498	422	24,952	22,048	3,618	5,662	0.14	0.26	1.27	2.46
2823	Cellulose Man-Made Fibers	66.7	1,703	1,131	12,918	13,557	2,378	2,244	0.18	0.17	1.53	1.54
283	Drugs	6.9	653	934	27,258	33,929	12,714	36,627	0.47	1.08	1.28	1.93
289	Other Chemical Products	10.9	333	243	17,767	19,509	2,152	7,623	0.12	0.39	1.03	1.70
2911	Petroleum Refining	6.1	239	539	14,446	26,693	2,054	2,122	0.14	0.08	3.50	4.45
30	Rubber and Plastic Products	11.4	502	781	14,048	12,558	4,957	20,983	0.35	1.67	1.87	2.14
3079	Plastic Products, N.E.C.[2]	15.7	240	317	12,265	11,166	15,667	12,120	1.28	1.09	1.33	1.92
3111	Leather Tanning and Finishing	19.8	186	236	8,920	9,254	6,000	12,545	0.67	1.36	1.00	1.18
3229	Pressed and Blown Glass	29.7	753	682	14,480	11,250	30,000	47,000	2.07	4.18	2.25	4.60
3241	Cement, Hydraulic	14.5	187	205	22,554	22,384	11,125	5,377	0.49	0.24	1.25	1.33
3312	Blast Furnaces	39.5	2,081	2,623	13,477	15,621	1,989	1,837	0.15	0.12	1.44	1.44
3317	Steel Pipe and Tubes	20.0	597	455	13,400	12,627	10,000	14,375	0.75	1.14	1.25	1.62
3321	Gray Iron Foundries	21.7	750	739	8,799	10,873	24,750	27,125	2.81	2.49	1.33	5.00
333	Primary Non-Ferrous Metals	9.8	964	551	18,518	21,952	3,906	2,189	0.21	0.10	1.22	1.88
3352	Aluminum Rolling and Drawing	22.0	1,338	729	14,940	11,699	42,000	14,368	2.81	1.23	9.00	1.47

[1] Recirculation rate equals gross water used divided by intake water withdrawn.
[2] Not elsewhere classified.

In general, within any industry, large plants and newer plants are more efficient producers than the smaller and older plants. Average sizes of plants in Appalachia and non-Appalachia are shown in table 10 as are the average values added by manufacture per employee for each of the selected industries. Value added per employee is an approximate measure of industry productivity which, when employed for comparison of plant production efficiency in the two regions, supports the general rule that the larger plants are more efficient than the smaller. For the majority of the industries in table 10, this is true. Where exceptions occur, the age of the establishments and the difference in products or the degree of finishing of products may explain the deviation.

The relationships between values added and water inputs, and between employment and water inputs for each industry, are presented in Table 10 to provide a means of relating water costs to production costs and to employment.

Water costs to industry vary considerably depending upon the source of the water, the quality and quantity required, and the degree of treament needed for the intake water, the recirculated water, and the plant effluents. For the United States as a whole, the cost of industrial water ranges between $30 and $350 per million gallons and averages about $80 per million gallons.

The relationship of value added to water intake provides a method for determining which industries are most likely to be attracted by low-cost water supplies. Those industries with low ratios of value added per million gallons of intake water are most dependent upon low cost water, since for them water represents a significant cost item.

The number of employees per million gallons of water intake allows an estimation to be made of the number of jobs that may be expected from the introduction of a new or enlarged manufacturing establishment with a large requirement for water. Employment estimates derived by this method will be generally conservative, however, because the incorporation in new plants of systems which allow in-plant reuse or recirculation of water may reduce the requirement for intake water, but still provide the number of jobs that a non-recirculating plant would have provided.

Variations in recirculation ratios for each of the selected industries in Appalachia and non-Appalachia are included in table 10.

CHAPTER VI

Profiles of Selected Industries

Five SIC four–digit industries and two SIC three–digit industry aggregates in which the Office of Appalachian Studies has expressed interest are the subjects of special scrutiny. The selection of industries and aggregates is a modification of the original selection made necessary by the availability of significant data in the Bureau of Census reporting of water use by Appalachian manufacturers.

SIC 2015--Poultry and Small Game

This industry comprises establishments primarily engaged in killing, dressing, packing and canning poultry, rabbits, and other small game for their own account or on a contract basis for the trade. The industry also includes the drying, freezing and breaking of eggs, but not the cleaning, oil treating, packing, and grading of eggs which are classified in wholesale trade. The specialization and coverage ratios for the industry were over 90 percent in both 1958 and 1963.

The specialization ratio is derived by dividing the total output of the industry (both primary and secondary products) into the industry's output of its primary products. The ratio, expressed as percentage, measures the extent to which the industry specializes in making its primary products.

Coverage ratio is a percentage measure of the primary product manufactured by the industry as compared to total manufacture of the product by all industries.

Tables 11 and 12 provide a statistical profile of SIC 2015 from 1958 through 1965 for the United States as a whole.

Poultry and Small Game in Appalachia

In 1963, there were 109 Appalachian establishments engaged in the dressing and packing of poultry and small game. Although many were small plants, in general the industry in Appalachia was comprised of larger establishments than reported for non-Appalachia for the same year, with approximately 38 percent of Appalachian plants employing 100 or more persons as compared to only 25 percent in the non-Appalachian industry.

Three states, Alabama, Georgia, and Pennsylvania, account for almost two-thirds of the establishments in Appalachia. However, the majority of establishments in Alabama and Georgia have over 50 employees while the most of the establishments in Pennsylvania have under 50 employees.

In table 11, the data on total employment, value added, and value of shipments point to SIC 2015 as a growing industry. Other data in Bureau of Census reports indicate

Table 11.—Poultry and Small Game Dressing and Packing, U.S. Industry Profile—SIC 2015

Year	Total employment		Value added ($1,000)	Value shipments ($1,000)	Capital expenditures, new ($1,000)
	Number	Payroll ($1,000)			
1958	62,389	160,813	310,572	1,888,166	28,079
1959	66,309	171,666	331,416	1,897,891	24,481
1960	67,792	178,139	369,074	2,053,815	22,974
1961	71,097	193,996	366,767	2,083,963	19,176
1962	66,916	190,179	374,421	2,078,248	19,261
1963	70,104	204,400	410,909	2,240,871	34,306
1964	71,345	218,800	422,153	2,329,534	21,297
1965	71,927	230,876	470,507	2,474,114	31,819

Table 12.—Poultry and Small Game Dressing and Packing Selected Data for Year 1963 by Size of Establishment—U.S. Totals—SIC 2015

	Total	Less than 20 employees	20 to 49 employees	50 to 99 employees	100 to 249 employees	250 to 499 employees	500 to 999 employees
Establishment	967	409	157	146	201	45	9
Percent	100.0	42.0	16.0	15.0	21.0	5.0	1.0
All employees	70,104	2,332	5,130	10,591	30,639	15,400	6,012
Percent	100.0	3.0	7.0	15.0	44.0	22.0	8.6
Payroll ($1,000)	204,400	6,533	14,107	29,472	90,150	46,009	18,129
Percent	100.0	3.0	7.0	14.0	44.0	22.0	9.0
Value added ($1,000)	410,909	18,992	32,248	59,503	185,556	86,420	28,190
Percent	100.0	5.0	8.0	14.0	45.0	21.0	7.0

that most of the industry's growth is occurring in the South and Central States, parts of which overlap Appalachia. Several factors influence the development of the industry in the South, and presumably in the Appalachian South. These are the relative mildness of climate, the availability of labor, and the suitability of poultry-raising as a substitute cash crop on small and marginal farm properties.

Of major concern to the industry is the marketing of products which are clean, free of disease organisms, attractively packaged, and with a minimum of spoilage. To satisfy this concern, large quantities of high quality water are needed. In Appalachia, as in the United States as a whole, about two-thirds of the industry's water needs are supplied from public water supply systems whose water quality would meet drinking water requirements. The remaining water requirement is met by supply from company owned wells and surface water sources. Of the 154 large water-using poultry dressing plants in the United States, 39 reported that they provided treatment for a total of about 1 billion gallons of intake water before using it in their plants. Seven of the plants provided filtration, presumably for water obtained from their own surface water sources. For most, however, the treatment generally employed was for removal of hardness and/or corrosion control, two methods generally associated with well water supplies and with water used for boiler feed.

Water is used by the industry primarily for washing the poultry and game and for cooling to remove the body heat before packaging. Other uses are in scalding, plant and equipment cleanup, and for general sanitation. A negligible amount is used for power generation. Chart 4 presents a simplified diagram of the distribution of water between the various plant uses.

In 1964, there were 22 SIC 2015 establishments in Appalachia which reported water intakes of 20 million gallons or more for the year. The significance of this group of establishments in regard to water withdrawals and the processing of food in general in Appalachia is major. Seventy-five percent of all water used for processing meats and meat products of all types in Appalachia was withdrawn by the SIC 2015 industry, which also accounted for 23 percent of the water withdrawals for all food and kindred products industries in Appalachia.

Poultry and small game dressing and packing by the large water-using establishments in Appalachia is generally more efficient than that of their counterparts in non-Appalachia. Appalachian plants use less water per dollar of value added, employ more persons per unit of water withdrawn, and have a higher value added per employee than the non-Appalachian plants.

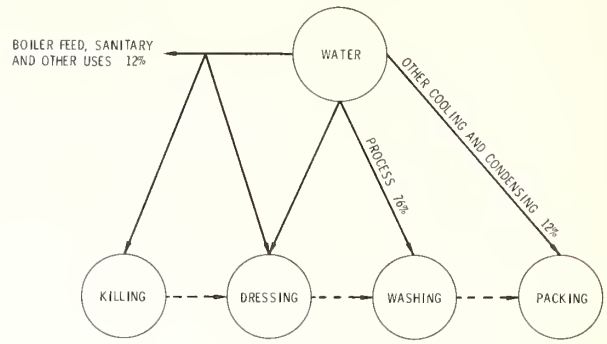
At present, the industry, not highly automated, requires considerable labor, as evidenced by the low value added per employee. The average annual wage of about $3,000 per employee illustrates the low-skill level of the employees utilized by the industry.

Table 13.—Large Water-Using Establishments, Appalachia, Non-Appalachia, and United States, 1964—SIC 2015

	United States	Appalachia	Non-Appalachia
Number of establishments	154	22	132
Employees	31,932	5,686	26,246
Value added per employee	$5,511	$5,979	$5,372
Value added per million gallons of intake water	$10,353	$11,333	$10,071
Employment per million gallons of intake water	1.88	1.90	1.87
Average plant size (number employees)	207	258	197

CHART 4
WATER USE DIAGRAM

SIC CODE 2015-POULTRY AND SMALL GAME DRESSING AND PACKING, WHOLESALE



SIC 2621--Paper Mills

This industry is comprised of establishments primarily engaged in manufacturing paper (except building paper —SIC 2661) from wood pulp and other fibers, and which may also manufacture converted paper products. Pulp mills combined with paper mills and not reported separately are also included in the industry; where separately reported, pulp mills are classified in SIC 2611. Establishments primarily engaged in manufacturing converted paper stocks are classified in SIC 264 or SIC 265.

The specialization ratio for SIC 2621 was 90 percent in 1958 and 1963. Coverage ratio for 1958 was 95 percent and for 1963, 92 percent.

Tables 14 and 15 provide a statistical profile of SIC 2621 from 1958 through 1965 for the United States as a whole.

The demand for paper and the vast variety of paper products has been increasing at a sustained high rate

Table 14.—Paper Mills, Except Building Paper U.S. Industry Profile, SIC 2621

Year	Total employment		Value added ($1,000)	Value shipments ($1,000)	Capital expenditures, new ($1,000)
	Number	Payroll ($1,000)			
1958	131,334	740,988	1,542,746	3,259,415	258,769
1959	134,799	790,174	1,829,909	3,668,595	214,497
1960	136,665	820,311	1,876,971	3,754,677	246,474
1961	132,423	817,960	1,865,237	3,712,941	285,235
1962	132,348	859,852	1,904,949	3,857,202	277,098
1963	129,848	877,942	1,857,203	3,824,915	232,779
1964	129,638	917,573	1,973,953	4,000,030	295,580
1965	131,741	957,027	2,042,755	4,278,102	468,089

Table 15.—Paper Mills, Except Building Paper Selected Data for Year 1963 by Size of Establishment
U.S. Totals, SIC 2621

	Total	Less than 20 Employees	20 to 49 Employees	50 to 99 Employees	100 to 249 Employees	250 to 499 Employees	500 to 999 Employees	1,000 and Over Employees
Establishments	325	12	35	48	85	56	56	32
Percent	100.0	3.7	10.8	14.8	26.2	17.2	17.2	9.8
Employees	129,848	121	1,172	3,543	13,684	19,988	38,703	52,637
Percent	100.0	.09	.90	2.7	10.5	15.4	29.8	40.5
Payroll ($1,000)	877,942	682	6,858	22,493	87,970	136,246	262,257	361,436
Percent	100.0	.08	.78	2.6	10.0	15.5	29.9	41.2
Value Added ($1,000)	1,857,203	880	15,299	45,501	176,344	265,045	597,841	756,293
Percent	100.0	.05	.82	2.4	9.5	14.3	32.2	40.7

since the turn of the century with the result that paper production has been doubling about every 15 years. Although dips and plateaus in the curve of growth have occurred, the overall trend shows no signs of leveling off. In 1964, 18,140,000 tons of paper were produced in the United States.

The industry utilizes a variety of fibers in the manufacture of its products; wood fibers, waste paper, rags, cotton linters, flax fibers and the like. Also, more than 600 organic and inorganic chemicals are used to impart particular qualities in the finished products. The variety of materials used and the large number of different products manufactured introduces considerable dissimilarity in the industry between plants located in different geographic regions, and between plants in the same region.

The industry is an extremely large user of water, ranking as the fourth largest user of water among all the SIC 4-digit industries, and accounting in 1964 for more than 8 percent of all the water withdrawn for manufacturing in the United States. A high quality water is required for the manufacture of paper, and as a consequence of the large volumes used, water represents a significant cost in paper manufacture. In recent years, with the increasing demands for improvement of plant effluents to abate the pollution of streams and lakes, the cost of waste treatment has added a sizeable increment to the overall cost of water for the papermakers. The industry, however, has shown remarkable progress in the modification of its uses of water to achieve reductions in water intake and improvements in pollution abatement. Between 1955 and 1964, pulp and paper production increased 68 percent, but water withdrawals increased only 9 percent.

In 1964, the SIC 2621 industry withdrew 1,138 billion gallons of water. Sixty-four percent of the water was used in processing the materials and products. The industry, a large user of electric energy, generated nearly 60 percent of the electric power it used, and for cooling and condensing in its own power plants, used 261 billion gallons of intake water. Other cooling and condensing required 73 billion gallons of the intake water. The industry uses steam, particularly in the pulping operation, and for this purpose withdrew 68 billion gallons of water.

Many of the paper mills are integrated with pulp mills and those using wood pulp as their major raw material are usually located in forest areas where high quality water is available. Yet, even so, the industry provided treatment for more than half of its water withdrawal before using it in its mills. Paper is extremely susceptible to contamination through absorption and adsorption of soluble and insoluble components in the water used for processing. Turbidity, color, hardness, alkalinity, iron and magnesium, silica, and dissolved gases all may present difficulties in processing and in quality control. The bacteriological quality of the water is also an important factor, since uncontrolled bacteriological organisms can cause clogging of screens, lower heat transfer coefficients, and poor fiber deposition. In general, the industry requires water that is at least equivalent in quality to drinking water, and even higher quality is required for use as boiler feed.

This need for high quality water is substantiated by the reports of the industry on the treatment it provided for its intake water. Of the 271 large water-using establishments in the industry, only 46 reported no treatment of intake water in 1964. More than one-half of the plants filtered their intake water, and more than one-half softened their water. Coagulation prior to filtration was provided by 110 paper mills; 50 plants treated the water for corrosion control; 16 plants aerated the water; and 23 plants reported using other unspecified treatment methods.

Paper mills, having spent money to treat water, recirculate the water within the mills. In 1964, recirculation, at a ratio of 2.72, permitted the gross water requirement of 3,095 billion gallons to be met with only 1,138 billion gallons of intake water. Chart 5 presents a simplified diagram of the uses of water by a hypothetical plant in the SIC 2621 industry.

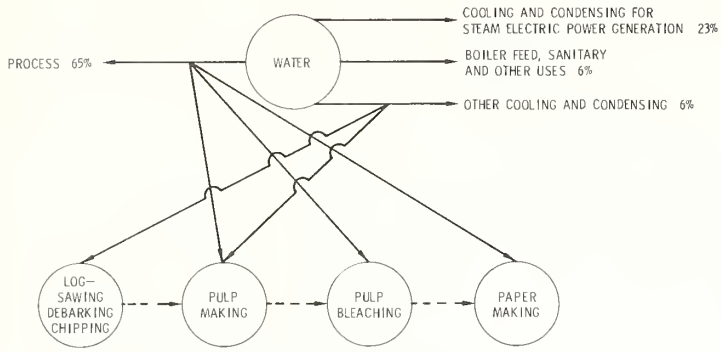
Paper Mills in Appalachia

In 1964, there were 19 establishments in Appalachia that were classified in SIC 2621. These plants ranged in size from one which employed less than 20 persons, to seven others employing more than 1,000 each. Total employment in the Appalachian establishments in 1964 was about 18,600. Eight paper mills were located in the Appalachian portion of Pennsylvania, with two in West Virginia, two in each of the Appalachian portions of Ohio, North Carolina, Tennessee and Alabama, and one in Maryland. No new plants have been constructed in Appalachia in recent years, but capital expenditures for new equipment, estimated to be between $10 and $15

CHART 5

WATER USE DIAGRAM

SIC CODE 2621 · PAPER MILLS, EXCEPT BUILDING PAPER MILLS



million annually, have kept the Appalachian plants competitive with those of non-Appalachia. Although the distribution of capital expenditures is unknown, it is probable that investments were made in more efficient materials handling systems, instrumentation and automated controls, high speed paper machines, computers for process control, and for pollution control equipment. Such investments permit increased production at lower cost, but reduce the number of jobs in the industry and require that already highly skilled employees further improve their skills.

Of the 19 Appalachian paper mills, 18 were large users of water. The average plant size of Appalachian paper mills, 1,032 employees, was 2½ times greater than the average mill in non-Appalachia, and in general, the Appalachian plants produced more per employee. As a consequence of larger plant size and more efficient operations, the Appalachian paper mills, representing only 6 percent of the Nation's papermaking establishments, accounted for nearly 16 percent of the value added in manufacture by the entire industry.

The 18 large water-using paper mills of Appalachia in 1964 withdrew 183 billion gallons of water and recirculated the water 4.81 times to make it equivalent to their 800 billion gallons gross water requirment. Only one paper mill, with a water use of 2 billion gallons for the year, did not recirculate. Appalachian paper mills treated a larger portion of their intake water before use than did the non-Appalachian mills, 65 percent as compared to 47.5 percent. Accounting for this is the larger proportion of intake water used by the Appalachian mills for cooling and condensing at company-run steam-electric power plants and the correspondingly greater need for control of corrosion and scaling of boiler and condenser tubes. The most commonly used treatment methods were softening (13 mills), coagulation and filteration, (11 mills), and ionexchange (8 mills).

The continuing upward trend in the demand for paper and paper products has resulted in the construction and enlargement of mills in the States which form part of

Table 16.—Large Water-Using Establishments, Appalachia, Non-Appalachia, and U.S., 1964, SIC 2621

	United States	Appalachia	Non-Appalachia
No. of establishments	271	18	253
Employees	120,447	18,584	101,863
Value added per employee	$14,413	$14,528	$14,391
Value added per million gallons of intake water	$1,525	$1,475	$1,535
Employment per million gallons of intake water	0.11	0.10	0.11
Average plant size (number employees)	444	1,032	402

Appalachia, but has not yet moved into Appalachia to a great degree. Since it is an industry that pays high wages, employs many workers, and provides a sizeable tax base for local communities, the development of the industry in Appalachia would be of considerable benefit to that region.

Comparison of several economic and water-related factors for the industry in Appalachia, non-Appalachia and the United States as a whole are presented in table 16.

SIC 2631--Paperboard Mills

This industry comprises establishments primarily engaged in manufacturing paperboard (including paperboard that is coated on the paperboard machine) from wood pulp and other fibers, and which may also manufacture converted paperboard products (confined almost exclusively to pasted, lined, laminated or surface-coated paperboard). Pulp mills combined with paperboard mills, and not separately reported, are also included in this industry; where separately reported, they are classified in industry 2611. This industry does not include establishments primarily engaged in manufacturing building board or converted paperboard products from purchased paperboard.

The specialization ratio of the industry dropped from 90 percent in 1958 to 85 percent in 1963. The coverage ratio was 90 percent in both 1958 and 1963.

Tables 17 and 18 provide a statistical profile of SIC 2631 from 1958 through 1965 for the United States as a whole.

Paperboard Manufacturing in the U.S.

The growth in demand for paperboard in the United States has coincided with the growth in demand for paper. To match this demand, the SIC 2631 industry has

Table 17.—Paperboard Mills, U.S. Industry Profile, SIC 2631

Year	Total employment		Value added ($1,000)	Value shipments ($1,000)	Capital expenditures, new ($1,000)
	Number	Payroll ($1,000)			
1958	57,086	321,765	840,057	1,690,918	102,100
1959	58,481	345,772	907,027	1,875,646	117,270
1960	58,325	353,779	940,353	1,882,496	135,713
1961	56,895	360,432	921,173	1,899,854	108,400
1962	58,491	382,468	995,400	2,034,577	125,585
1963	63,398	429,017	1,186,224	2,315,954	159,528
1964	64,236	450,445	1,271,367	2,491,068	214,441
1965	64,828	472,505	1,390,571	2,676,796	209,106

Table 18.—Paperboard Mills Selected Data for Year 1963 by Size of Establishment, SIC 2631

	Total	Less than 20 employees	20 to 49 employees	50 to 99 employees	100 to 249 employees	250 to 499 employees	500 to 999 employees	1,000 and over employees
Establishments	271	12	41	55	95	36	22	10
Percent	100	4.4	15.1	20.3	35.0	13.3	8.1	3.7
All employees	63,398	103	1,496	4,011	14,493	12,127	14,618	16,550
Percent	100	0.16	2.4	6.3	22.9	19.1	23.0	26.1
Payroll ($1,000)	429,017	556	8,643	26,192	95,202	87,383	101,955	109,086
Percent	100	0.13	2.0	6.1	22.9	20.4	23.8	25.4
Value added ($1,000)	1,186,224	1,034	18,342	54,031	229,538	211,372	334,780	337,127
Percent	100	0.09	1.5	4.6	19.4	17.8	28.2	28.4

been increasing production at an average annual rate of nearly 5 percent during the past 10 years. In 1965, production of paperboard was nearly 21 million tons, exceeding the previous year's production record by more than 1 million tons.

Although some paperboard is also manufactured as secondary products by pulp mills (SIC 2611), paper mills (SIC 2621), and building paper and board mills (SIC 2661), 90 percent of all paperboard produced is manufactured by establishments in SIC Industry 2631. In 1963, there were 271 establishments classified in the paperboard industry as compared to 252 establishments in 1958, and employment had increased during the same period from 57,086 to 63,398. The growth in demand for paperboard shows no signs of slacking, and to meet this demand old plants must be expanded, new plants must be built, and new jobs will be generated.

Although many fibers are used in the manufacture of paperboard, wood pulp and waste paper account for about 90 percent of the fibers used by the industry. Many different organic and inorganic chemicals are used to control color, size, hardness, and finish in the variety of special paperboards which the industry produces. About 25 percent of the paperboard mills have their own pulp-making plants as an integral unit of their plant facility, while the remainder operate with pulp obtained from other sources. In general, the paperboard mills that are integrated with pulp mills are the larger plants of the industry and are the plants that account for the majority of the water used in paperboard manufacture. However, water is a major input in the manufacture of paperboard even in plants that do not make their own pulps, and of the total 271 establishments in the industry, 183 reported water withdrawals that exceeded 20 million gallons during the year 1964.

Together, the 183 large water-using paperboard establishments in 1964 withdrew 577 billion gallons of water which placed Industry SIC 2631 in the rank as the fifth largest user of water among all SIC 4–digit industries in the U.S. manufacturing sector. As a group, the paperboard manufacturers used 58 percent of the intake water in processing operations, 23 percent as cooling and condensing water in company-operated, steam-electric power plants, 14 percent for cooling and condensing in process operations, and 5 percent for boiler feed water, sanitary needs, and other uses. Recirculation of water by the industry, at an average recirculation ratio of 3.2, made it possible for the 577 billion gallons of intake water to meet the industry's gross water requirement of 1,845 billion gallons. In the operations of the industry, about 33 billion gallons of the intake water was lost by evaporation or incorporated into products. Chart 6 presents a simplified diagram of the uses of water by the paperboard industry.

Although the manufacture of paperboard is less sensitive to poor quality water than is the manufacture of paper, the paperboard industry must nevertheless control the quality of the water it uses in order to insure that the deposition of fibers is consistant, that sizings and coatings and other chemical additives are not interfered with by dissolved or suspended matter in the water, and to reduce or prevent the fouling and scaling of heat-exchange surfaces. More than 40 percent of the intake water used by the industry was treated before use in the mills. Only 41 of the large water-using establishments had sources of raw water available of a quality that did not require treatment. The treatment methods most commonly used were coagulation and filtration, softening and ion exchange, and corrosion control, which reflected the concern for process and quality control and the prevention of fouling, scaling, and corrosion in their heat exchange units.

Paperboard Manufacturing in Appalachia

In Appalachia in 1964, 20 establishments were engaged in the activities of industry SIC 2631. By comparison with the paperboard mills of non-Appalachia, the mills of Appalachia were small. The average plant in Appalachia employed about 130 employees, while the average plant outside of the region employed about 235. The locations of paperboard mills were well distributed among the Appalachian States, except for the Appalachian portions of Kentucky, Maryland, and Virginia, which had none.

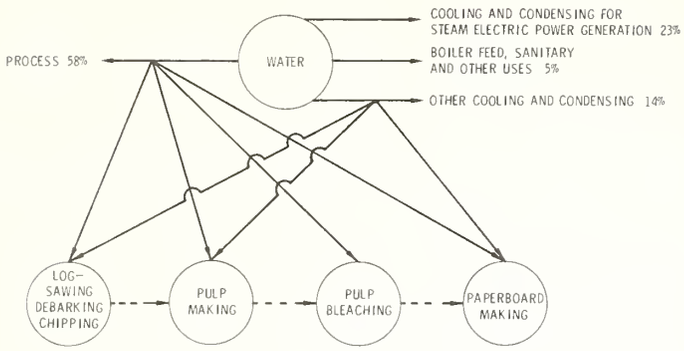
Of the 20 paperboard mills, 16 establishments employing a total of 2,515 employees reported water withdrawals that exceeded 20 million gallons during 1964. Those large water-using mills, ranging in size from 20 employees to more than 500, withdrew a total of 17 billion gallons of water in 1964 for a combined manufacturing activity of $63 million of value added by manufacture.

The distribution of the intake water by use within the Appalachian paperboard mills differed significantly from that of the total U.S. industry. About 60 percent

CHART 6

WATER USE DIAGRAM

SIC CODE 2631-PAPERBOARD MILLS



of the intake water was used as process water and slightly less than 18 percent was used for cooling and condensing in steam-electric power plants in Appalachia, as compared to 58 percent and 23 percent for all U.S. paperboard manufacture. It is probable that these differences are explained in part by the greater use of purchased power by the relatively small mills of Appalachia which reduced the requirement for cooling and condensing water at company-owned, steam-electric power plants. An additional explanation, however, may be found in the greater recirculation of water by the Appalachian industry, whose average recirculation rate of 6.2 times, as compared to 3.2 times for the U.S. industry as a whole, would reduce the requirement for cooling water withdrawals.

Water quality requirements for paperboard manufacture in Appalachia are probably similar to those of the U.S. industry as a whole, in that 47 percent of the Appalachian intake water was treated before use. However, no information on treatment practices in Appalachia has been reported.

In table 19, comparisons of economic and water related factors are reported for the industry in Appalachia, non-Appalachia, and the United States as a whole. Although the Appalachian industry represents too small a sample of the total industry for valid conclusions, it appears that the Appalachian paperboard mills enjoyed greater productivity per employee and per unit of water intake and provided more jobs per equivalent quantity of intake water than the non-Appalachian mills. Although the total employment in the industry is small, it is probable that additional jobs for skilled workers will be created in Appalachia through enlargement of existing mills and construction of new mills.

Table 19.—Large Water-Using Establishments Appalachia, Non-Appalachia, and U.S. 1964—SIC 2631

	United States	Appalachia	Non-Appalachia
Number of establishments	183	16	167
Employees	56,696	2,515	54,181
Value added per employee	$19,366	$25,049	$19,102
Value added per million gallons of intake water	$1,903	$3,706	$1,848
Employment per million gallons of intake water	.10	.15	.10
Average plant size (number employees)	310	157	324

SIC 2812--Alkalies and Chlorine

Industry 2812 consists of establishments primarily engaged in manufacturing sodium hydroxide, potassium hydroxide, soda ash, potassium carbonate, sodium bicarbonate, sal soda, and chlorine. It does not include establishments primarily manufacturing ammonium compounds or alkali metals; nor does it include establishments engaged in mining natural potassium and sodium alkalies. The primary product specialization ratio for SIC 2812 dropped from 73 percent in 1958 to 66 percent in 1963 indicating increasing activity in the production of secondary products. During the same period, the coverage ratio dropped from 84 percent to 79 percent.

The following tables provide a statistical profile of the industry from 1958 through 1965.

Table 20.—Alkalies and Chlorine, U.S. Industry Profile, SIC 2812

Year	Total employment		Value added ($1,000)	Value shipments ($1,000)	Capital expenditures, new ($1,000)
	Number	Payroll ($1,000)			
1958	20,476	115,024	306,187	504,309	27,871
1959	20,144	120,205	347,932	565,287	43,442
1960	20,475	126,542	360,126	576,690	32,395
1961	19,891	128,007	363,355	589,036	42,213
1962	19,714	132,309	392,296	628,112	69,009
1963	19,652	138,156	389,243	652,120	57,470
1964	19,927	145,261	436,023	711,574	49,396
1965	20,015	148,237	441,977	735,442	57,680

Table 21.—Alkalies and Chlorine Selected Data for Year 1963 by Size of Establishment, U.S. Totals SIC 2812

	Total	Less than 100 employees	100 to 249 employees	250 to 499 employees	500 to 999 employees	1,000 and over employees
Establishment	38	11	10	4	7	6
Percent	100.0	28.9	26.3	10.5	18.4	15.8
All employees	19,652	637	1,642	1,370	5,113	10,890
Percent	100.0	3.2	8.4	7.0	26.0	55.4
Payroll ($1,000)	138,156	4,328	10,884	9,489	38,604	74,851
Percent	100.0	3.1	7.9	6.9	27.9	54.2
Value added ($1,000)	389,243	12,845	51,665	32,886	115,505	176,342
Percent	100.0	3.3	3.3	8.4	29.7	45.3

Although capital expenditures by the industry for new plant and equipment are large and have been increasing, employment in numbers has remained essentially unchanged since 1958. Between 1958 and 1965, the number of establishments increased from 34 to 38 and the annual value added by manufacture, an indication of productivity, increased from $306 milion to $442 million. Employment during the same period, however, showed a slight drop from 20,476 employees to 20,015. Most of the capital invested in this industry has been for the automation of equipment and sophisticated process and quality control facilities, which has resulted in increased employment of skilled labor but less of unskilled labor.

Water Use by the U.S. Industry

The manufacture of alkalies and chlorine requires large volumes of water. In the United States in 1964, 31 of the total 38 establishments in SIC 2812 reported water withdrawals of 20 million gallons or more for the year, while the total amount of water withdrawn by the industry was 528 billion gallons. Cooling and condensing required more than 90 percent of the total water input, with 363 billion gallons used in process cooling and condensing, and 115 billion gallons used at company owned steam-electric power plants.

Only 3 percent of the intake water, 16 billion gallons, was used as process water. Boiler feed water, sanitary needs, and other uses accounted for the remainder of the intake, 35 billion gallons. Relatively little of the water taken in by the industry, about 19 percent, was recirculated for multiple use, which suggests that cooling and condensing was performed as a once through operation. Quality of intake water, except for that withdrawn for boiler feed and sanitary uses, did not appear of great concern to the industry, since only 31 billion gallons were treated before use and one-third of the establishments provided no treatment at all. Chart 7 presents a simplified diagram of water uses by SIC 2812.

CHART 7
WATER USE DIAGRAM
SIC CODE 2812-ALKALIES AND CHLORINE

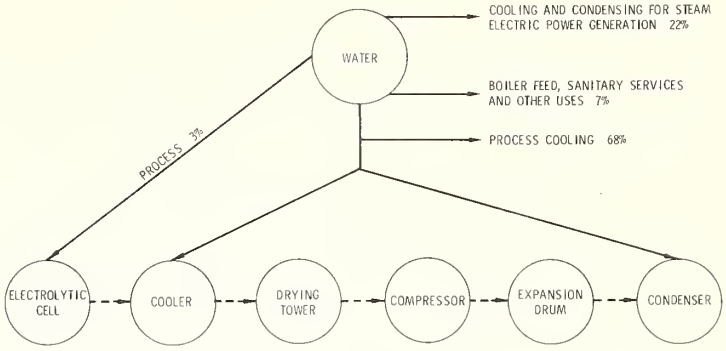


Table 22.—Large Water-Using Establishments, Appalachia, Non-Appalachia and U.S., 1964—SIC 2812

	United States	Appalachia	Non-Appalachia
No. of establishments	31	6	25
Employees	19,090	3,895	15,195
Value added per employee	$19,958	$23,106	$19,151
Value added per million gallons of intake water	$722	$703	$728
Employment per million gallons of intake water	0.04	0.03	0.04
Average plant size (number employees)	615	649	607

Alkalies and Chlorine in Appalachia

Six establishments in Appalachia manufacture alkalies and chlorine, all of which reported withdrawals of 20 million gallons or more of water during 1964, and all of which employed at least 100 persons. Four plants were located in the Tennessee River basin where local salt deposits, cheap electric energy, good transportation facilities, and major market industries exist. Two plants were located in West Virginia for similiar reasons. Common to all sites are ample sources of water. The major markets for the Appalachia industry are the paper and allied products, textiles, rubber and plastics, and the chemicals and allied products industries, many of which are concentrated in or close to Appalachia.

A total of 128 billion gallons of water were withdrawn by the six Appalachian manufacturers of alkalies and chlorine. Their use of the water differed from that of the non-Appalachian industry, in that nearly 97 percent of the intake was used for cooling and condensing, and only 1 billion gallons, or less than 1 percent for boiler feed water, sanitary, and other uses. The small water requirement for boiler feed, sanitary, and other uses in the Appalachian industry reflects the use of purchased electric power from the regional pool of low-cost energy which reduces the industry's requirement for water used in company operated steam electric power plants. As was the case for the U.S. industry as a whole, about 3 percent of the intake was used as process water.

Recirculation of water was practiced in 5 of the 6 Appalachian establishments, but recirculation amounted to less than 10 percent of the intake water. It is obvious that these Appalachian establishments have available ample sources of suitable quality water, and that the costs of obtaining water are very low. The availability of ample water at low cost may be deduced from the low ratio of of value added per million gallons of water intake, $703 per million gallons. If water use were restricted and if water costs were not minimal, the industry would withdraw less water and recirculate it more.

Comparisons of several economic and water-related factors for the industry in Appalachia, non-Appalachia, and the United States as a whole are presented in Table 22.

Although the alkalies and chlorine industry in Appalachia is an important supplier of process chemicals for other major industries in Appalachia and its surroundings, and is a major water-using industry, it does not provide Appalachia many jobs. Judging from the recent history of the industry in the United States, it also appears unlikely that expansions in production will result in a significant increase in employment. The present industry pattern of using water on a once-through basis suggests that conservation of considerable quantities for other uses can be realized if the industry were to practice in-plant recirculation of its intake water.

SIC 2821--Plastic Materials

This industry is comprised of establishments primarily engaged in manufacturing synthetic resins, plastic materials, and non-vulcanizable elastomers. The industry's important products include: cellulose plastic materials; phenolic and other tar acid resins; urea and melamine

resins; vinyl and styrene resins; petroleum polymer resins; casein plastics; polyesters; and many miscellaneous resins and plastics. The industry does not include establishments which purchase the resins or plastic materials to produce fabricated plastic products, films, and sheets, which are classified in SIC 3079. The specialization and coverage ratios for SIC 2821 in 1963 were 84 percent and 64 percent respectively. Tables 23 and 24 present a statistical profile of the industry from 1958 through 1965.

Table 23.—Plastic Materials and Synthetic Resins, U.S. Industry Profile, SIC 2821

Year	Total employment		Value added ($1,000)	Value shipments ($1,000)	Capital expenditures, new ($1,000)
	Number	Payroll ($1,000)			
1958	51,003	308,212	871,956	1,846,667	178,882
1959	54,148	344,432	1,110,661	2,236,262	132,039
1960	55,269	358,981	1,041,376	2,183,038	155,026
1961	54,457	369,264	968,510	2,124,489	157,349
1962	57,674	401,498	1,102,045	2,372,111	149,516
1963	61,366	437,566	1,202,349	2,571,492	137,781
1964	62,530	461,250	1,344,543	2,772,075	202,972
1965	65,462	495,175	1,474,515	3,096,195	267,287

The output of plastics and synthetic resins increased at an average annual rate of 17.8 percent between 1957 and 1964, making SIC 2821 one of the fastest growing industries in the manufacturing sector. New plastics with properties not available in earlier plastics are expanding the areas of usage, and continued improvements in the engineering of plastics are expanding their use in structures, boats, automobiles, chemical plant equipment, and the aerospace industries. Production costs are being reduced through applied research and development for which the industry in 1963 budgeted $1.3 billion, a figure which has been increasing about 5 percent annually. The industry is expected to continue its rapid growth rate well into the 1970's with employment increasing about 4.2 percent annually.

Water Use By the U.S. SIC 2821 Industry

Of the 509 establishments of this industry recorded in the 1963 *Census of Manufactures*, 114 reported water withdrawals that exceeded 20 million gallons a year. The 1964 data on water use in manufacturing reports on those 114 establishments, but it is quite likely that in the year between the census and the follow-up water canvass additional establishments would have moved into the large water-using category and been missed in the canvass. This would have occurred through the enlargement of plants and through the entrance of about 30 new plants annually into the SIC 2821 industry, some of which would undoubtedly have been large water users.

The 114 establishments canvassed reported total water withdrawals of 218 billion gallons, and accounted for $1,120 million of value added in manufacture, almost 84 percent of the total value added by the industry. They are large plants with an average employment of 437 in 1964 and including several plants that employ more than 2,500 persons.

The industry used 82.6 percent of its intake water for cooling and condensing with 167 billion gallons for cooling and condensing in process operations and 13 billion gallons for cooling and condensing in steam-electric power plants. For use in the processing of the materials and products, the industry withdrew 25 billion gallons, or about 11.5 percent of the total intake. The remainder of the intake, 11 billion gallons, was used for boiler feed water, sanitary and other uses. The average recirculation ratio for the industry, 1.32, provided for the industry's gross water requirement of 288 billion gallons. Chart 8 presents a simplified diagram of the use of water by SIC 2821.

In general, the quality required by the industry was satisfied by the raw intake water without treatment. Only 38 billion gallons received treatment before use, and

CHART 8

WATER USE DIAGRAM

SIC 2821-PLASTIC MATERIAL AND RESINS

(MANUFACTURE OF CELLULOSE ACETATE PLASTIC)

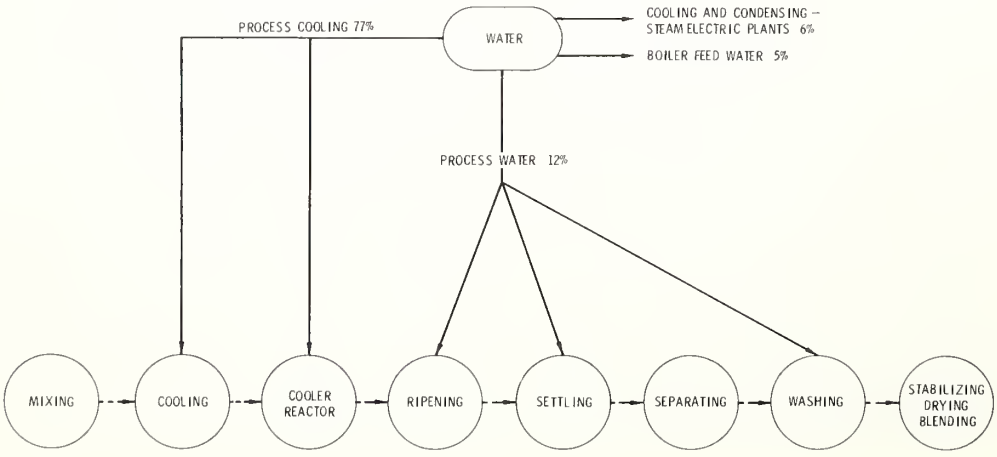


Table 24.—Plastic Materials and Synthetic Resins Selected Data for Years 1963 by Size of Establishment, U.S. Totals, SIC 2821

	Total	Less than 20 employees	20 to 49 employees	50 to 99 employees	100 to 249 employees	250 to 499 employees	500 to 999 employees	1,000 to 2,499 employees	2,500 and over employees
Establishments	509	253	103	59	41	24	16	9	4
Percent	100.0	49.7	20.2	11.6	8.0	4.7	3.1	1.8	.78
All employees	61,366	1,869	3,189	4,116	6,695	7,973	11,832	14,324	11,368
Percent	100.0	3.0	5.2	6.7	10.9	13.0	19.3	23.3	18.5
Payroll ($1,000)	437,566	11,288	20,175	26,356	48,487	57,161	81,791	103,402	88,896
Percent	100.0	2.6	4.6	6.0	11.1	13.1	18.7	23.6	20.3
Value added ($1,000)	1,202,349	38,158	66,265	70,624	179,181	185,009	208,867	234,206	220,039
Percent	100.0	3.2	5.5	5.9	14.9	15.4	17.4	19.5	19.3

the treatment processes employed, mainly softening, ion exchange and corrosion control, were probably applied mostly for the cooling and boiler feed water.

Water Use by the Appalachian Industry

Of a total of 34 establishments manufacturing plastics and resins in Appalachia in 1963, 16 reported water intakes exceeding 20 million gallons during 1964. In general, the industry in Appalachia, by proportion, has more large water users than the U.S. industry as a whole, and the average size of the large water-using Appalachian plant, 500 employees, is slightly larger.

These large water-using plants withdrew a total of 55 billion gallons of water in 1964, and recirculated it at a ratio of 1.28 to provide for the gross water requirement of 70 billion gallons. The uses made of the intake water by the Appalachian manufacturers was similar to those of the U.S. industry, with about 80 percent used for cooling and condensing, 16 percent in processes, and about 4 percent for boiler feed, sanitary and other uses. Only 4 billion gallons, or about 7.2 percent of the intake water, was treated before use. The treatment methods employed, primarily for softening, ion-exchange, and corrosion control, similar to the U.S. industry, were probably for cooling and boiler feed.

Table 25 presents economic and water related data for SIC 2821 in Appalachia, non-Appalachia, and the United States as a whole. In general, the Appalachian large water users were more productive, with their value added per employee about 14 percent higher than that of the non-Appalachian plants. The latter, however, used much less water per unit of value added than did the Appalachian plants. Such comparisons in this industry, with its very complex mix of raw materials and products, and its rapid growth rate, are probably of limited value for area assessments.

Table 25.—Large Water-Using Establishments, Appalachia, Non-Appalachia, and United States—1964—SIC 2821

	United States	Appalachia	Non-Appalachia
No. of establishments	114	16	98*
Employees	49,839	7,975	41,864
Value added/employee	$22,472	$24,952	$22,000*
Value added/million gallons of intake water	$5,138	$3,618	$5,650*
Employment/million gallons of intake water	0.23	0.14	0.26
Average plant size (number employees)	437	498	427*

* —The figures for Value Added and No. of Establishments for Non-Appalachia have been adjusted to make Appalachia and Non-Appalachia equal the U.S. total.

SIC 3312--Blast Furnaces

This industry is comprised of establishments engaged in manufacturing hot metal, pig iron, silvery pig iron, and ferroalloys from iron ore and iron and steel scrap; converting pig iron, scrap iron and scrap steel into steel; and in hot rolling iron and steel into basic shapes such as plates, sheets, strips, rods, bars, and tubing. Merchant blast furnances and by-product or beehive coke ovens are also included in this industry. Although the specialization and coverage ratios cannot be precisely measured for this industry, they are estimated to be 94 percent and 86 percent respectively.

Tables 26 and 27 provide a statistical profile of the industry from 1958 through 1965 for the United States as a whole.

Table 26.—Blast Furnaces and Steel Mills, U.S. Industry Profile, SIC 3312

Year	Total employment		Value added ($1,000)	Value shipments ($1,000)	Capital expenditures, new ($1,000)
	Number	Payroll ($1,000)			
1958	511,392	3,183,483	6,062,227	13,422,585	959,033
1959	507,540	3,448,374	6,823,398	15,628,664	669,266
1960	549,956	3,629,384	6,844,374	15,738,776	1,190,707
1961	503,417	3,523,170	6,546,304	14,873,318	805,462
1962	502,202	3,612,064	6,620,897	15,571,583	707,767
1963	500,550	3,711,639	7,506,433	16,417,981	908,440
1964	532,860	4,117,920	8,479,602	18,840,101	1,282,861
1965	563,567	4,436,609	9,283,783	20,514,183	1,363,960

Iron and Steel Manufacturing in Appalachia

In 1963, there were 108 establishments operating in Appalachia in the manufacture of iron and steel, and hot rolling of the iron and steel into basic shapes. The industry is greatly concentrated in Appalachian Pennsylvania where 66 of the plants are located. Other States with concentrations of the industry are Alabama with 14 plants, Ohio with 8 plants, and West Virginia with 7 plants. Iron and steelmaking is a large plant activity; only 37 of the Appalachian iron and steel mills employed less than 250 persons and the average plant employment exceeded 2,000.

Appalachia plants are old establishments, for it was in this region that steelmaking in the United States had its beginning. But as the Nation's needs for iron and steel have grown, the expansion of the industry has occurred in other regions, nearer to markets, closer to sources of supplies, and better served by transportation facilities. Although new plants are not being built in Appalachia, plant modernization has been occurring which

Table 27.—Blast Furnace and Steel Mills—SIC 3312

	Total	Less than 20 employees	20 to 49 employees	50 to 99 employees	100 to 249 employees	250 to 499 employees	500 to 999 employees	1,000 to 2,499	2,500 and over
Establishments	288	41	20	6	43	41	40	33	64
Percent	100.0	14.2	6.9	2.1	14.9	14.2	13.9	11.4	22.2
Employees	500,500	236	606	377	6,871	15,048	29,186	53,843	394,383
Percent	100.0	.05	.12	.08	1.4	3.0	5.8	10.8	78.8
Payroll ($1,000)	3,711,639	1,225	3,295	2,021	44,083	105,507	211,609	382,306	2,961,593
Percent	100.0	.03	.09	.05	1.2	2.8	5.7	10.3	79.8
Value added ($1,000)	7,699,535	2,588	7,430	3,306	98,793	212,287	366,906	691,271	6,316,954
Percent	100.0	.03	.10	.04	1.3	2.8	4.8	9.0	82.0

has resulted in lower costs of production and less employment with shifts in employment qualifications toward higher skilled labor. The modernization has included the use of beneficiated ores, self-fluxing agglomerates, larger blast furnaces, hydrocarbon injection to reduce coke requirements, the replacement of open hearth furnaces with basic oxygen furnaces, lance-injection of oxygen into conventional open hearth furnaces, continous casting of steel, computer controlled furnace operations, faster automated rolling mills, and many other innovations. These trends will continue with a resultant decrease in employment, particularly at the lower-skill level.

Iron and steelmaking is the largest user of water among all manufacturing in Appalachia, accounting for more than 41 percent of all manufacturing water withdrawals by the large water-using industries. This large quantity of water, 1,114 billion gallons in 1964, was withdrawn by 79 establishments, employing 164,423 persons, for production, measured in value added in manufacture, of $2,216 million dollars.

Of the 1,114 billion gallons of water withdrawn by the Appalachian industry, only 158 billion gallons received treatment before use, and 25 of the 79 large water-using establishments reportedly provided no treatment. The plants treating water were concerned primarily with the removal of hardness, with 42 of the 54 plants treating with the lime-soda softening process and 13 using ion-exchange. It is most probable that this water was used for boiler feed in company-owned steam electric power plants, and in steam boilers for in-plant steam uses. Twenty-five plants treated the water for corrosion control, and coagulation and filtration also occurred at 25 plants, probably also in preparation for use in boilers and for sanitary needs.

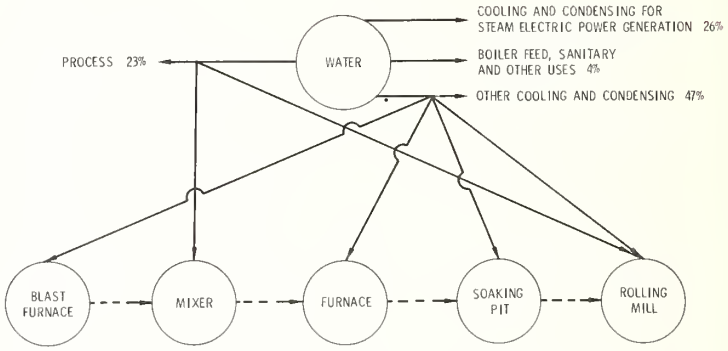
In general, the Appalachian iron and steelmakers, although using a large volume of water, do not require that it all be of high quality. This circumstance is paralleled in non-Appalachia where SIC 3312 industry establishments provided treatment for only 16 percent of their intake water even though it included 268 billion gallons of brackish water.

Water is used in iron and steelmaking primarily as a coolant for furnaces, rolls and other equipment, in quenching baths, and for removal of scale and other adherents on the metal. Those uses accounted for nearly 73 percent of water withdrawals by the Appalachian manufacturers. Power generation used about 20 percent for cooling and condensing, and the remainder was used

CHART 9

WATER USE DIAGRAM

SIC 3312-BLAST FURNACES AND STEEL MILLS



for boiler feed, sanitary service, and miscellaneous purposes. Because of the possibilities for evaporative losses in scale removal and steel rolling where temperatures are high, water consumption in SIC 3312 is high, with about 7.5 percent less discharged than taken into the plants. Although no information is available on recirculation in individual plants in Appalachia, as a whole, the Appalachian SIC 3312 industries used their intake water 1.4 times, which is about the same as that reported by the non-Appalachia industry. Chart 9 is a simplified diagram of water use in a hypothetical plant manufacturing iron and steel.

Relating water use to production, measured by value added by manufacture, the Appalachian industry made more effective use of water, with $1,989 of value added per million gallons of intake, as compared to $1,837 by non-Appalachian plants. Relating water use to employment, Appalachian plants use about 25 percent more employees per unit of water intake than non-Appalachian plants. Plant size and employee productivity, however, are less in the Appalachian iron and steel industry.

Table 28.—Large Water-Using Establishments, Appalachia, Non-Appalachia, and United States—1964—SIC 3312

	United States	Appalachia	Non-Appalachia
No. of establishments	200	79	121
Employees	481,867	164,423	317,444
Value added per employee	$14,890	$13,477	$15,622
Value added per million gallons of intake water	$1,881	$1,989	$1,837
Employment per million gallons of intake water	0.13	0.15	0.12
Average plant size (number employees)	2,409	2,081	2,623

At present, and during periods of high demand for steel, the Appalachian iron and steel industry provides employment at good wages for a large number of persons. When demand slackens, however, the Appalachian plants, with their higher production costs, are among the first to reduce operations. Modernization is taking place in the Appalachian industry making its establishments more competitive with the newer mills in the Great Lakes and Southwest regions, so it appears unlikely that the industry will diminish. It is also unlikely though that these activities will be increased in Appalachia. The long term trend will be a reduction in employment due to automation, rather than the creation of additional employment.

SIC 283--Drugs

This aggregate of SIC 4-digit industries is comprised of establishments primarily engaged in manufacturing and processing biological products such as vaccines, toxoids, serums, plasmas and other blood derivatives for human or veterinary use (SIC 2831); establishments engaged in manufacturing organic or inorganic medicinals and processing bulk botanical drugs and herbs (SIC 2833), and establishments primarily engaged in manufacturing, processing or fabricating drugs into pharmaceutical preparations, usually in a form intended for final consumption (SIC 2834). For reasons of disclosure, Bureau of Census data on water use is reported only at the SIC 3-digit level for Appalachia.

Table 29 presents a statistical profile of the SIC 283 industry aggregate constructed by combining data on the SIC 4-digit industries contained in the aggregate.

Table 29.—Drugs—U.S. Industry Aggregate Profile, SIC 283

Year	Total employment		Value added ($1,000)	Value shipments ($1,000)	Capital expenditures, new ($1,000)
	Number	Payroll ($1,000)			
1958	95,940	545,691	2,096,288	2,977,950	111,688
1959	99,887	594,298	2,274,468	3,129,556	N.A.
1960	103,762	623,591	2,354,393	3,214,271	115,649
1961	102,263	635,087	2,445,885	3,311,404	106,977
1962	106,127	684,212	2,635,995	3,540,949	95,015
1963	99,002	673,775	2,807,331	3,715,860	113,328
1964	101,611	718,145	2,943,281	3,921,352	118,182
1965	104,242	771,826	3,351,999	4,386,270	136,707

SIC 283 is dominated by pharmaceutical manufacturing establishments of SIC 2834, which provides 90 percent of the employment, accounts for 94 percent of the value added in manufacture, and which receives 89 percent of the capital expenditures for new plant and equipment. Because of its importance, a statistical profile of SIC 2834 is presented in table 30.

Within SIC 283 in 1963, there were 113 establishments in SIC 2831, 138 in SIC 2833, and 1,011 in SIC 2834. The specialization ratios for the three industries in 1963 was 88 percent, 71 percent, and 87 percent, respectively, indicating that secondary products manufacture represented a substantial part of each industry's activity. The

Table 30.—Pharmaceutical Preparations—U.S. Industry Totals, SIC 2834

Year	Total employment		Value added ($1,000)	Value shipments ($1,000)	Capital expenditures, new ($1,000)
	Number	Payroll ($1,000)			
1958	82,002	466,596	1,881,524	2,591,831	72,353
1959	83,722	495,887	2,015,470	2,692,187	82,770
1960	86,658	517,627	2,085,206	2,772,131	85,120
1961	87,984	549,104	2,223,734	2,926,625	86,448
1962	91,225	588,711	2,413,544	3,142,174	71,485
1963	85,084	580,638	2,595,657	3,314,323	89,286
1964	90,229	639,822	2,766,153	3,571,088	102,740
1965	94,004	697,366	3,151,146	4,038,571	121,923

coverage ratios for SIC 2831 was 45 percent, with SIC 2833, 47 percent, while SIC 2834 was 94 percent. The low coverage ratios for SIC 2831 and 2833 are accounted for by the manufacture of their primary products by SIC 2834, SIC 2818 (Organic Chemicals), and other industries.

The three drug industries have experienced markedly different growth rates. SIC 2834 is the only one which has sustained a steady growth, with employment rising from 82,000 in 1958 to 94,000 in 1963, and value added by manufacture increasing from $1.9 billion to $3.1 billion in the same period.

SIC 2831 reached a peak in 1962, then drifted slowly downward to 1965. Its employment rose from 3,692 in 1958 to 5,892 in 1962, and dropped to 5,195 in 1965. The value added in manufacture showed a similar trend, rising from $38.95 million to $65.74 million and then falling to $63.67 million.

SIC 2833, Medicinal Chemicals and Botanical Products declined markedly, with employment falling from 10,246 in 1958 to 5,043 in 1965. During the same period, value added fell $175.8 million to $137.2 million.

The above declines, rather than resulting from a diminishing market for the special products of the two industries, probably are the result of the reclassification of the establishments into other SIC 4-digit categories.

Information on water use by SIC 283 establishments is reported in the Bureau of Census *Water Use in Manufacturing*, 1964 report, but of the SIC 4-digit industries within the group, only SIC 2834 receives detailed reporting.

Among the 1,262 establishments in the United States classified in SIC 283, were 72 that reported water withdrawals exceeding 20 million gallons during 1964. The total water intake amounted to 65 billion gallons of which 28 billion gallons were withdrawn by 55 establishments classified as SIC 2834. The remaining 37 billion gallons were withdrawn by 17 establishments classified as SIC 2831 or 2833, but the number of plants in each of those categories and the distribution of the water intake are not revealed.

Table 31 presents economic and water related factors for the industry aggregate SIC 283 and for SIC 2834, its major component.

Water is used by the industries primarily for cooling and condensing in the processing of their products for which 49 billion gallons of the 65 billion gallons with-

Table 31.—Selected Data—Large Water Using Establishments—SIC 283, SIC 2834, and Combined SIC 2831 and SIC 2833 U.S. Industry Totals, 1964

	SIC 283	SIC 2834	SIC 2831 plus SIC 2833
No. of establishments	72	55	17
Employees	65,894	58,107	7,787
Value Added Per Employee	$33,600	$35,950	$16,052
Value added per million gallons of water intake	$34,061	$74,607	$3,378
Employment per million gallons of water intake	1.01	2.08	0.21
Average plant size (number employees)	915	2,075	458

drawn is used. About 5 billion gallons enter into the processes requiring direct contact with the raw materials and products. Another 5 billion gallons are used for boiler feed and sanitary uses, primarily to provide steam and water for maintaining the high sanitary standards of the industry. About 6 billion gallons are used for cooling and condensing at company owned steam electric power plants.

Relatively little of the water, 7 billion gallons, is treated before use, and the most common treatment methods, softening, ion-exchange, and corrosion control, suggest that the quality required improvement, for the most part, only when used for cooling and condensing and for boiler feed. Other treatments employed were aeration, coagulation and filtration, and unspecified methods, which were probably required for process water, a part of which was obtained from surface sources.

Drug Manufacture in Appalachia

In the 1963 *Census of Manufactures*, 62 establishments in industry aggregate SIC 283 were reported in Appalachia. SIC 2834 was represented by 53 plants of which only 4 employed more than 100 persons. SIC 2833 was represented by 7 establishments, only 2 of which employed more than 50 person, and SIC 2831 establishments numbered only 2, 1 of which employed less than 20 persons, and the other more than 100.

Only 5 establishments reported water withdrawals that exceeded 20 million gallons for the year 1964, and together the 5 plants withdrew 7 billion gallons. The distribution of water withdrawals between the 3 industries is not known, but we belive that the 5 plants included 2 in SIC 2833, (of which 1 plant employed between 500 and 1000 persons and the other between 50 and 100), one plant in SIC 2831 (employing between 100 and 250 persons), and one in SIC 2834 (employing between 500 and 1000 persons). The fifth large water-using establishment may have been one in SIC 2833 which employed between 50 and 100 persons, or in SIC 2834 which employed between 250 and 500 persons.

Little information is available in regard to the use of the water within the establishments in Appalachia. According to the data in Table 2A of the Appendix, less than 500 million gallons were used in processing and in boiler feed and sanitary uses. None was used for cooling and condensing in steam-electric power plants. Reported as being used for process cooling and condensing was 7 billion gallons which is equal to the total intake reported. This inconsistency results from the practice by the Bureau of Census of rounding off its water gallonage figures to the nearest billion gallons, and of reporting less than 500 million gallons as an asterisk. One billion gallons of water was treated before use, but data is also lacking in regard to the methods of treatment. It may be assumed, however, that water treatment by the Appalachian establishments was by similar methods and for similar purposes as was reported for the U.S. industry.

As a part of the large water-using manufacturing sector of Appalachia, SIC 283 fills a relatively minor role. Its large water-using establishments in 1964 employed 3,264 persons (0.4 percent of total large water-using manufacturing employment), accounted for $89 million of value added in manufacture (0.9 percent of the sectors value added), and withdrew 7 billion gallons of water (0.26 percent of the water withdrawn).

SIC 333--Primary Smelting, Non-Ferrous Metals

SIC 333 is an aggregate of five SIC 4–digit industries. These industries are composed of establishments primarily engaged in Smelting and Refining Copper (SIC 3331); Smelting and Refining Lead (SIC 3332); Smelting and Refining Zinc (SIC 3333); Smelting and Refining Aluminum (SIC 3334); and Smelting and Refining of Non-Ferrous Metals, Not Elsewhere Classified, (SIC 3339). Establishments that are primarily engaged in rolling, drawing or extruding non-ferrous metals are classified in industry aggregate SIC 335.

Specialization and coverage ratios are not available for the primary copper and lead industries because there is extensive duplication in the reporting of shipments by these industries. The specialization and coverage ratios for the remaining three industries in 1963 were respectively: SIC 3333, 92 percent and 81 percent; SIC 3334, 100 percent and 75 percent; and SIC 3339, 83 percent and 39 percent.

Table 32 presents a statistical profile of SIC 333 constructed by combining data for its component 4–digit industries. Tables 33 and 34 present separate profiles for Primary Smelting and Refining of Zinc (SIC 3333) and Aluminum (SIC 3334), the two industries of the aggregate which are most significant in Appalachia.

Table 32.—Primary Smelting and Refining of Non-Ferrous Metals U.S. Industry Aggregate Profile, SIC 333

Year	Total employment		Value added ($1,000)	Value Shipments ($1,000)	Capital expenditures, new ($1,000)
	Number	Payroll ($1,000)			
1958	47,247	267,172	708,523	2,292,401	179,791
1959	45,045	265,949	792,475	2,210,244	N.A.
1960	49,413	307,633	940,919	2,773,778	52,344
1961	46,694	296,807	866,750	2,811,305	52,517
1962	48,322	315,375	920,393	2,919,004	33,483
1963	48,789	327,814	1,012,581	3,094,219	87,439
1964	50,934	343,156	1,089,115	3,423,576	76,866
1965	52,483	371,651	1,125,089	3,905,739	126,811

Table 33.—Primary Smelting and Refining, Zinc
U.S. Industry Profile, SIC 3333

Year	Total employment		Value added ($1,000)	Value shipments ($1,000)	Capital expenditures, new ($1,000)
	Number	Payroll ($1,000)			
1958	8,923	44,078	71,653	208,993	13,445
1959	8,625	45,500	80,581	236,403	4,080
1960	8,582	47,675	94,611	252,408	3,017
1961	8,361	46,875	84,206	257,410	2,739
1962	8,449	48,535	76,297	258,468	4,501
1963	8,065	47,760	98,789	281,537	4,734
1964	8,621	51,911	143,335	336,940	5,142
1965	8,443	53,494	125,231	362,034	7,321

Table 34.—Primary Smelting and Refining, Aluminum
U.S. Industry Profile, SIC 3334

Year	Total employment		Value added ($1,000)	Value shipments ($1,000)	Capital expenditures, new ($1,000)
	Number	Payroll ($1,000)			
1958	17,381	111,588	383,836	808,822	142,293
1959	17,997	122,606	459,285	953,775	38,534
1960	17,848	123,956	472,711	921,215	26,647
1961	16,201	117,151	454,206	953,894	19,258
1962	17,221	125,584	471,980	1,014,921	10,798
1963	18,133	134,116	499,576	1,089,977	62,172
1964	20,332	146,576	549,205	1,191,409	51,804
1965	20,779	157,447	640,850	1,384,517	79,994

Due to disclosure limitations imposed by the relatively small number of establishments in each industry, data on employment, value added, etc., by employment size of establishment are not reported in detail and no breakdown can be devolped for the SIC 333 aggregate as a whole. Table 35 presents distribution of establishments by employment size for each of the five industries and for the three-digit aggregate as a whole.

Table 35.—Primary Smelting and Refining of Non-Ferrous Metals
Distribution of Establishments by Industry and by Employment Size, 1963, SIC 333

	Total	Under 50 employees	50 to 99 employees	100 to 249 employees	250 to 499 employees	500 to 999 employees	1000 to 2499 employees
SIC 3331—primary copper	33	3	1	11	6	8	4
SIC 3332—primary lead	10	1	--	4	4	1	--
SIC 3333—primary zinc	18	1	1	4	5	5	2
SIC 3334—primary aluminum	23	2	--	--	5	10	6
SIC 3339—primary non-ferrous metals, N.E.C.	35	14	6	8	4	3	--
SIC 333 Total	119	21	8	27	24	27	12

Water Use by the U.S. SIC 333 Aggregate

In 1964, 72 establishments of the 119 classified in SIC 333 reported water withdrawals of 20 million gallons or more. These 72 establishments employed 42,054 persons of the total 48,789 employed and accounted for 88.9 percent of the total value added by manufacture, or nearly $900 million dollars. As in other industries, large water use and large plant size accompany each other, and the 72 establishments, averaging 534 employees each, withdrew a total of 386 billion gallons. There are large differences in the amounts needed to refine metals in each of the four-digit industries in SIC 333. There may also be significant differences among the plants within an industry, depending on the processes used.

For the greatest part of their supply, the industries rely upon their own sources, withdrawing 220 billion gallons from surface fresh water supplies, 27 billion gallons from fresh water wells, and 127 billion gallons of brackish water from oceans, estuaries and wells. About 10 percent of their supply, 38 billion gallons, was obtained from public water supply systems.

The recirculation of water supplies by the establishments varies considerably, depending upon the availability and quality of water intake, the degree of ore beneficiation required, and the method of refining. In the United States as a whole, the recirculation ratio of 1.82 permitted the water withdrawal to serve as the equivalent of 704 billion gallons, but seven of the establishments did not recirculate.

The major use of intake water, 69 percent, is for cooling and condensing in company operated steam electric power generating plants. This high water use reflects the large electric power requirements of the industry for the electrolytic processes that are employed, particularly the refining of copper and aluminum, the big two of the industry aggregate. A relatively large volume, 19 billion gallons, was used for boiler feed, sanitary and other uses, again reflecting the need for electric power from steam generating plants to which the bulk of the boiler feed water was diverted. Other cooling and condensing, in furnaces, casting rooms, etc., used 46 billion gallons. As would be expected, losses through evaporation were high; 16 billion gallons of water were consumed by the non-ferrous industries in 1964.

The primary aluminum refining industry, SIC 3334, is by far the largest water user of the industry aggregate. The establishments in that industry accounted for 51 percent of the water withdrawals, 48 percent of the gross water requirement, (yet only 5 of the 20 establishments in SIC 3334 recirculated water), and 58 percent of the water used at company owned steam-electric power plants. This latter water use was for the generation of more than 10 billion kilowatt-hours of electricity, which represented about 25 percent of the aluminum industry's power needs. About 13 billion gallons of water were used by the aluminum plants for process operations, of which more than 70 percent, or 9 billion gallons, was used for gas scrubbing of stack effluents for recovery of materials, by-products, and air pollution control.

Water Use by the Appalachian SIC 333 Industries

In 1964, seven SIC 333 establishments in Appalachia were reported as large water users. Table 36 provides a listing of establishments by SIC 4-digit industry, by state and by plant size for Appalachia in 1963. It is from among this group of establishments that the seven large water users reported, but it is not known for certain, which establishments constitute the seven. Undoubtedly, however, the four establishments in SIC 3334 and the two larger in SIC 3333 were among them.

Table 36.—Primary Non-Ferrous Metals in Appalachia 1963
Establishments by Industry, by State, by Size, SIC 333

	Total	Under 100 employees	100 to 249 employees	250 to 499 employees	500 to 999 employees	1000 and over
SIC 3331						
Tenn.	1	1				
SIC 3333						
Pa.	2					2
W. Va.	1		1			
SIC 3334						
W. Va.	1				1	
Ohio	1					1
Tenn.	1					1
Ala.	1					1
SIC 3339						
Pa.	1			1		
Tenn.	1			1		

Little data is available on the manufacturing activities of the SIC 333 industries in Appalachia, since the small number of establishments makes such reporting extremely sensitive to the requirements against disclosure.

The four aluminum refining establishments in Appalachia had a combined capacity of about 670,000 tons of aluminum annually in 1964, which was about 36 percent of the total U.S. production of that year. However, the actual production of those plants is not known, and efforts to estimate water use, employment, and value added, through use of national data, fail to provide meaningful figures. Because no use data is available in the *Census of Manufactures* water canvass for SIC 3333, Zinc Refining, at either the national or Appalachian level, it is not possible to make deductions as to the distribution of water use.

Such being the case, comparisons of water use by the industries in Appalachia and non-Appalachia can be made only at the SIC 333 level.

The Appalachian establishments in 1964 withdrew 32 billion gallons recirculating at an average ratio of 1.22 to meet the gross water requirement of 39 billion gallons. Cooling and condensing constituted the largest use of water, accounting for 87.5 percent of the total withdrawal, with 23 billion gallons used in steam-electric power plants and 5 billion used in process cooling and condensing. The remaining 4 billion gallons was distributed more or less equally between process use, and boiler feed water and sanitary uses. Two billion gallons were treated before use, but the methods of treatment are not known. About 3 billion gallons of the intake water was obtained from public supplies, and the remainder from company surface and ground supplies. No brackish water was reported as having been withdrawn by the Appalachia industries.

Since all seven plants reported recirculating at least some of their water, but together recirculated relatively little, it is apparent that the plants are located in areas where restrictions on water use, whether due to quality or quantity, have not caused the plants to be concerned with in-plant conservation.

In table 37, data is presented to allow comparisons of several economic and water related factors for the SIC industry aggregate in Appalachia and non-Appalachia. As will be noted, this is a reporting of SIC 333 from which data on SIC 3331, Copper, and SIC 3332, Lead, have been deleted. The deletions were made because of the absence or minor presence of those two industries in Appalachia.

Table 37.—Selected Data—Large Water-Using Establishments, Appalachia, Non-Appalachia, U.S. as A Whole, 1964, SIC 333

(Less SIC 3331 and 3332 Industries)

	Appalachia	Non-Appalachia	United States
No. of establishments	7	37	44
Employees	6,750	23,668	30.418
Value added/employees	$18,518	$22,731	$21,796
Value added/million gallons of intake water	$3,906	$1,697	$1,900
Employment/million gallons of intake water	0.21	0.08	0.09
Average plant size (number employees)	964	640	691

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Appendix A

The Counties of Appalachia

New York

Chautauqua
Cattarangus
Allegany
Steuben
Schuyler
Chemung
Tompkins
Tioga
Cortland
Broome
Chenango
Otsego
Delaware

Pennsylvania

Erie
Crawford
Mercer
Lawrence
Beaver
Washington
Green
Warren
Venango
Butler
Allegheny
Fayette
Westmorland
Armstrong
Clarion
Forest
McKeon
Elk
Jefferson
Indiana
Somerset
Cambria
Clearfield
Cameron
Potter
Clinton
Centre
Blair
Bedford
Fulton
Huntington
Mufflin
Juniata
Perry
Snyder
North Lumberland
Mountour
Schuylkill
Columbia
Luzerne
Carbon
Union
Lycoming
Tioga
Bradford
Sullivan
Susquehanna
Wyoming
Lackawana
Wayne
Pike
Monroe

Maryland

Garrett
Allegany
Washington

West Virginia

(All counties)

Ohio

Holmes
Tuscarawas
Carroll
Jefferson
Harrison
Coshocton
Muskingum
Guernsey
Belmont
Monroe
Noble
Morgan
Perry
Washington
Hocking
Athens
Ross
Vinton
Meigs
Jackson
Gallia
Lawrence
Pike
Scioto
Highland
Adams
Clermont
Brown

Virginia

Highland
Bath
Alleghany
Botetourt
Craig
Giles
Pulaski
Floyd
Carroll
Grayson
Wythe
Bland
Tazewell
Smyth
Washington
Russell
Buchanan
Dickenson
Wise
Scott
Lee

Kentucky

Lewis
Greenup
Fleming
Rowan
Carter
Boyd
Bath
Elliott
Lawrence
Montgomery
Menifee
Morgan
Martin
Johnson
Clark
Powell
Wolfe
Magoffin
Floyd
Pike
Madison
Estill
Lee
Breathitt
Knott
Garrard
Jackson
Owsley
Perry
Letcher
Leslie
Clay
Laurel

Rockcastle
Lincoln
Casey
Pulaski
Knox
Harlan
Bell
Whitley
McCreary
Wayne
Russell
Clinton
Cumberland
Monroe
Adair
Green

North Carolina

Ashe
Alleghany
Surry
Stokes
Watawga
Wilkes
Yadkin
Forsyth
Davie
Alexander
Caldwell
Avery
Mitchell
Burke
Yancey
McDowell
Madison
Buncombe
Rutherford
Haywood
Henderson
Polk
Swain
Jackson
Transylvania
Graham
Macon
Cherokee
Clay

South Carolina

Cherokee
Spantanburg
Greenville
Pickens
Anderson
Oconee

Georgia

Dade
Walker
Catoosa
Whitfield
Murray
Fannin
Gilmer
Union
Towns
Lumpkin
White
Rabun
Habersham
Stephens
Chattooga
Gordon
Pickens
Dawson
Hall
Banks
Franklin
Floyd
Bartow
Cherokee
Forsyth
Jackson
Madison
Barrow
Gwinette
Paulding
Polk
Haralson
Douglas
Carroll
Heard

Tennessee

Macon
Clay
Pickeet
Scott
Campbell
Claiborne
Union
Hancock
Hawkins
Sullivan
Johnson
Carter
Washington
Unicoi
Greene
Hamblen
Grainger
Jefferson
Cocke
Sevier
Knox
Anderson
Blount
Monroe
Polk
McMinn
Loudon
Roane
Morgan
Fentress
Cumberland
Bledsoe
Rhea
Meigs
Hamilton
Bradley
Maricn
Sequatchie
Overton
Putnam
White
Vanburen
Grundy
Franklin
Coffee
Warren
De Kalb
Smith
Jackson

Alabama

Lauderdale
Limestone
Madison
Jackson
DeKalb
Marshall
Morgan
Lawrence
Colbert
Franklin
Marion
Winston
Cullman
Blount
Etowah
Cherokee
Fayette
Walker
Jefferson
St. Clair
Calhoun
Cleburne
Tuscaloosa
Shelby
Talladega
Clay
Randolph
Chambers
Tallapoosa
Coosa
Elmore
Chilton
Bibb

Appendix B

Bureau of Census Tables--Water Use by Manufacturers

Appalachia and Non-Appalachia

Table 1.--1964 WATER USE IN MANUFACTURING INDUSTRIES BY MAJOR INDUSTRY GROUPS; TOTAL U.S., NON-APPALACHIA, APPALACHIA

(In billion gallons, except employees)

SIC Code		Water intake			Gross water used	Water discharged		All employees (1,000)
		Total	Fresh	Brackish		Total	Treated prior to discharge	
	Total U.S.	14,045	11,209	2,836	30,599	13,157	3,825	6,397
	Total Non-Appalachia	11,360	8,531	2,828	26,130	10,611	3,367	5,672
	Total Appalachia	2,686	2,678	8	4,468	2,546	458	745
20	Food and Kindred Products:							
	Total U.S.	760	681	79	1,280	688	158	626
	Total Non-Appalachia	746	668	79	1,254	676	156	601
	Total Appalachia	13	13	*	25	12	2	25
21	Tobacco Manufactures:							
	Total U.S.	3	3	-	19	2	*	31
	Total Non-Appalachia	1	1	-	14	1	*	20
	Total Appalachia	1	1	-	5	1	*	11
22	Textile Mill Products:							
	Total U.S.	148	146	1	311	135	35	353
	Total Non-Appalachia	111	110	1	228	103	26	239
	Total Appalachia	36	36	-	83	32	9	114
24	Lumber and Wood Products:							
	Total U.S.	151	126	24	217	123	34	66
	Total Non-Appalachia	n.a	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Total Appalachia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
25	Furniture and Fixtures:							
	Total U.S.	3	3	-	4	3	*	35
	Total Non-Appalachia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Total Appalachia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
26	Paper and Allied Products:							
	Total U.S.	2,071	1,918	152	6,026	1,947	707	249
	Total Non-Appalachia	1,863	1,711	152	5,107	1,765	620	225
	Total Appalachia	207	207	-	919	182	86	23
28	Chemicals and Allied Products:							
	Total U.S.	3,888	2,548	1,340	7,577	3,662	580	480
	Total Non-Appalachia	2,954	243	1,335	6,374	2,749	482	421
	Total Appalachia	934	929	5	1,203	913	98	79
29	Petroleum and Coal Products:							
	Total U.S.	1,398	710	688	6,161	1,317	1,006	119
	Total Non-Appalachia	1,375	129	688	6,084	1,296	993	116
	Total Appalachia	23	23	-	77	21	13	3
30	Rubber and Plastics Products:							
	Total U.S., n.e.c.	163	162	1	336	155	9	210
	Total Non-Appalachia	116	115	1	248	110	6	194
	Total Appalachia	47	47	-	88	45	3	17
31	Leather and Leather Products:							
	Total U.S.	16	16	*	18	15	7	26
	Total Non-Appalachia	11	11	*	13	10	6	21
	Total Appalachia	5	5	-	5	5	1	5
32	Stone, Clay, and Glass Products:							
	Total U.S.	249	209	39	389	218	41	218
	Total Non-Appalachia	223	184	39	341	193	36	173
	Total Appalachia	25	25	*	47	25	5	45
33	Primary Metal Industries:							
	Total U.S.	4,578	4,150	428	6,778	4,312	1,178	814
	Total Non-Appalachia	3,226	2,798	428	4,841	3,045	941	590
	Total Appalachia	1,352	1,352	*	1,938	1,267	237	224
34	Fabricated Metal Products:							
	Total U.S.	57	56	2	123	53	9	258
	Total Non-Appalachia	52	50	2	116	47	9	226
	Total Appalachia	6	6	-	7	5	*	32
35	Machinery, Except Electrical:							
	Total U.S.	157	129	27	287	149	12	531
	Total Non-Appalachia	151	124	27	277	143	11	490
	Total Appalachia	6	5	1	10	6	1	41
36	Electrical Machinery:							
	Total U.S.	105	104	1	266	91	15	800
	Total Non-Appalachia	88	87	1	235	74	13	728
	Total Appalachia	17	17	*	31	17	2	73
37	Transportation Equipment:							
	Total U.S.	247	193	54	663	237	24	1,206
	Total Non-Appalachia	238	187	52	643	229	23	1,170
	Total Appalachia	8	7	2	19	8	1	35
38	Instruments and Related Products:							
	Total U.S.	29	29	*	76	26	9	146
	Total Non-Appalachia	26	26	*	68	24	9	138
	Total Appalachia	3	3	-	7	2	*	7
39	Miscellaneous Manufacturing:							
	Total U.S.	13	13	-	22	12	*	43
	Total Non-Appalachia	12	12	-	21	11	*	41
	Total Appalachia	1	1	-	1	1	*	2

Note: Detail figures may not add to totals due to rounding. Data reported for establishments using 20 million gallons or more per year.
- Represents zero.
*Less than 500 million gallons.

Table 2A.--APPALACHIA--WATER INTAKE BY PURPOSE, GROSS WATER USED, AND WATER DISCHARGED, BY INDUSTRY GROUPS, AND INDUSTRIES: 1964

Code	Establishments reporting consumption of water			Water intake by purpose					Boiler feed, sanitary service, and other uses (billion gallons)	Establishments recirculating or reusing water (number)	Gross Water used, including recirculating or reuse (billion gallons)	Total water discharged (billion gallons)
				All purposes			Cooling and condensing					
	All employees (number)	Value added by manufacture adjusted (million dollars)	Total (number)	Total (billion gallons)	Treated prior to use (billion gallons)	Process (billion gallons)	Steam electric power generation (billion gallons)	Other (billion gallons)				
U.S. total...	6,416,341	95,224	8,925	14,046	2,932	3,702	2,856	6,528	960	6,141	30,598	13,157
Appalachia...	744,607	9,914	1,010	2,686	412	515	516	1,500	155	656	4,468	2,546
20.....	25,115	362	131	13	2	5	*	5	3	78	25	12
201.....	7,371	49	32	4	*	3	*	*	1	18	4	3
2015.....	5,686	34	22	3	*	2	*	*	*	13	3	3
202.....	5,071	72	41	4	*	1	*	2	1	26	7	4
2026.....	4,235	59	28	2	*	1	*	1	1	20	5	3
203.....	4,063	101	17	2	*	1	*	1	*	11	3	2
2033.....	2,560	72	10	1	*	1	-	*	*	6	2	1
208.....	4,688	86	24	2	1	1	*	1	1	15	4	2
2082.....	2,572	40	12	1	1	1	*	*	*	8	3	1
209.....	1,530	19	8	1	*	*	-	1	*	2	6	1
2094.....	122	1	4	1	*	-	-	1	*	-	1	1
21.....	11,442	462	3	1	*	1	*	*	*	2	5	1
22.....	113,509	812	172	36	21	24	2	6	4	107	83	32
2211.....	41,577	245	48	8	4	4	2	1	1	34	33	6
2221.....	22,782	171	28	4	2	2	*	*	1	22	15	3
2231.....	2,893	24	6	1	1	1	-	*	*	5	2	1
225.....	17,107	115	21	2	1	1	-	*	*	10	5	1
2251.....	9,676	63	7	*	*	*	-	*	*	5	3	*
226.....	9,511	77	30	10	7	10	*	*	1	13	12	9
2261.....	5,090	39	10	6	4	6	*	*	*	6	7	5
2262.....	1,876	17	7	2	1	2	-	*	*	2	3	2
2269.....	2,545	21	13	2	2	2	-	*	*	5	2	2
227.....	6,111	88	13	3	1	2	*	*	1	7	4	3
228.....	7,881	49	18	2	2	2	-	*	*	12	5	2
2281.....	4,105	23	9	1	*	*	-	*	*	4	2	*
2284.....	2,910	21	5	2	1	1	-	*	*	4	3	1
229.....	4,328	35	6	6	2	2	*	3	*	3	8	6
26.....	23,465	364	41	207	133	111	72	15	9	37	919	182
2621.....	18,584	270	18	183	119	97	67	12	7	17	800	161
2631.....	2,515	63	16	17	8	10	3	3	1	14	106	16
264.....	1,448	20	4	6	5	3	2	*	*	4	10	4
28.....	78,904	1,838	123	934	76	44	69	790	31	84	1,203	913
281.....	32,531	1,017	65	675	39	12	54	595	14	43	834	658
2812.....	3,895	90	6	128	2	3	21	103	2	5	140	123
2815.....	2,873	88	11	7	1	1	*	5	1	9	24	6
2818.....	14,067	559	17	392	15	4	9	371	7	11	413	388
2819.....	10,291	248	15	87	20	3	7	73	4	10	185	80
282.....	37,840	634	34	204	32	28	15	149	12	28	311	202
2821.....	7,975	199	16	55	4	9	1	44	2	13	70	55
2823.....	20,436	264	12	111	21	15	14	74	7	9	170	110
283.....	3,265	89	5	7	1	*	-	7	*	4	9	7
289.....	3,996	71	12	33	4	3	-	26	4	6	34	32
2899.....	872	30	6	10	*	1	-	6	3	1	10	10
29.....	3,385	51	17	23	3	1	-	19	2	14	77	21
2911.....	3,115	45	13	22	3	1	-	19	2	12	77	21
30.....	16,585	233	33	47	2	3	1	41	1	21	88	45
3079.....	3,832	47	16	3	1	*	*	2	*	7	4	3
31.....	5,389	40	19	5	1	4	*	*	*	11	5	5
3111.....	3,363	30	18	5	1	4	*	*	*	10	5	5
32.....	44,600	534	96	25	6	10	1	11	3	53	47	25
322.....	20,211	228	25	5	3	1	*	2	1	16	13	5
3221.....	11,924	109	14	1	*	*	*	1	*	9	4	1
3229.....	8,287	120	11	4	3	1	-	2	1	7	9	4
3241.....	3,946	89	21	8	*	2	1	5	1	11	10	10
326.....	5,762	45	8	1	*	*	-	*	*	4	1	1
327.....	659	8	8	1	*	*	-	*	*	3	1	1
329.....	1,926	28	11	2	*	1	*	1	*	6	3	1
3291.....	464	8	3	1	*	*	*	*	*	2	1	1
33.....	223,776	2,972	163	1,352	162	298	362	600	93	120	1,938	1,267
331.....	175,784	2,342	100	1,305	159	291	338	587	88	76	1,843	1,224
3312.....	164,423	2,216	79	1,114	158	288	226	520	80	60	1,609	1,034
3317.....	2,985	40	5	4	*	2	1	1	*	3	5	3
332.....	17,942	168	26	5	*	2	*	2	1	18	10	4
3321.....	11,251	99	15	4	*	2	*	2	1	9	6	3
333.....	6,750	125	7	32	2	2	23	5	2	7	39	30
335.....	20,070	299	20	9	1	3	*	5	2	15	44	8
3352.....	12,047	168	9	4	*	1	*	2	1	7	36	4
3356.....	4,186	78	4	3	*	*	-	2	*	3	3	2
339.....	1,067	13	5	1	*	*	-	*	*	1	1	*
34.....	31,780	368	66	6	1	3	*	1	2	36	7	5
342.....	3,000	35	6	1	*	*	-	*	*	4	1	1
344.....	8,885	92	13	2	1	1	*	*	1	5	2	2
3461.....	6,443	83	12	1	*	1	*	*	*	6	1	1
349.....	7,035	84	13	1	*	*	*	*	*	8	1	1
3494.....	5,273	56	7	1	*	*	*	*	*	6	1	*

Table 2A.--APPALACHIA--WATER INTAKE BY PURPOSE, GROSS WATER USED, AND WATER DISCHARGED, BY INDUSTRY GROUPS, AND INDUSTRIES: 1964--Cont.

Code	Establishments reporting consumption of water			Water intake by purpose					Boiler feed, sanitary service, and other uses (billion gallons)	Establishments recirculating or reusing water (number)	Gross Water used, including recirculating or reuse (billion gallons)	Total water discharged (billion gallons)
				All purposes			Cooling and condensing					
	All employees	Value added by manufacture adjusted (million dollars)	Total (number)	Total (billion gallons)	Treated prior to use (billion gallons)	Process (billion gallons)	Steam electric power generation (billion gallons)	Other (billion gallons)				
35.....	41,219	381	36	6	1	2	*	2	2	23	10	6
354.....	7,874	88	8	2	*	*	-	1	*	6	3	2
356.....	9,987	95	10	1	*	*	-	1	*	7	2	1
3561.....	5,955	54	3	1	*	*	-	*	*	3	1	*
357.....	13,521	88	6	2	*	*	-	*	1	2	3	2
36.....	72,876	831	61	17	1	3	8	4	2	35	31	17
361.....	14,699	174	9	4	*	*	3	1	*	5	7	4
362.....	10,349	142	10	7	*	1	5	1	*	8	12	7
364.....	5,955	95	9	2	*	1	-	*	*	3	2	1
366.....	19,283	216	7	1	*	*	-	*	*	5	5	1
367.....	19,912	180	20	3	*	1	-	1	1	11	5	3
3679.....	12,950	111	13	2	*	1	-	1	*	6	2	2
37.....	35,470	476	23	8	1	5	1	1	1	18	19	8
371.....	9,747	194	9	3	*	2	*	*	*	6	5	2
372.....	10,826	106	5	3	*	3	-	*	*	5	4	3
374.....	14,034	168	8	3	*	*	1	1	1	6	11	2
38.....	7,273	91	8	3	*	*	*	2	*	7	7	2
39.....	2,284	26	7	1	*	1	-	*	*	3	1	1

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all components industries whether or not separate figures are shown for the individual industries.

- Represents zero.

* Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 2B.--NON-APPALACHIA--WATER INTAKE BY PURPOSE, GROSS WATER USED, AND WATER DISCHARGED, BY INDUSTRY GROUPS, AND INDUSTRIES: 1964

Code	Establishments reporting consumption of water			Water intake by purpose					Boiler feed, sanitary service, and other uses (billion gallons)	Establishments recirculating or reusing water (number)	Gross water used, including recirculation or reuse (billion gallons)	Total water discharged (billion gallons)
				All purposes			Cooling and condensing					
	All employees (number)	Value added by manufacture adjusted (million dollars)	Total (number)	Total (billion gallons)	Treated prior to use (billion gallons)	Process (billion gallons)	Steam electric power generation (billion gallons)	Other (billion gallons)				
Non-Appalachia, total.....	5,671,734	85,310	7,915	11,360	2,520	3,187	2,339	5,028	805	5,485	26,130	10,611
20.....	600,991	9,711	2,274	746	111	259	55	332	101	1,482	1,254	676
201.....	153,274	1,555	411	102	21	49	3	26	24	248	161	95
2015.....	26,246	141	132	14	1	10	*	1	2	60	16	14
202.....	71,095	1,033	521	58	7	12	4	27	15	334	97	54
2021.....	2,995	33	61	8	1	1	1	5	1	39	10	7
2026.....	51,074	659	289	28	3	9	1	8	10	196	45	26
203.....	118,131	1,570	439	90	14	50	1	29	10	307	150	85
2031.....	4,824	69	14	2	*	1	-	1	1	2	2	2
2033.....	53,459	611	229	34	3	19	*	10	4	180	48	31
2035.....	7,440	106	31	3	*	1	-	1	1	17	5	3
2036.....	3,422	19	13	1	*	*	*	*	*	3	1	1
2043.....	9,882	332	11	5	1	1	*	3	1	10	5	3
2046.....	12,572	283	17	48	10	5	5	32	5	13	72	42
206.....	28,666	525	123	242	29	105	28	99	10	99	412	220
2061.....	6,661	99	46	123	4	80	17	21	6	32	252	113
2062.....	10,944	231	19	65	3	4	11	47	3	15	74	59
2063.....	11,061	196	58	54	22	22	-	30	2	52	86	49
208.....	91,034	2,155	305	106	17	23	6	54	24	216	168	92
2082.....	54,263	1,149	107	57	9	13	6	21	18	86	91	50
2083.....	1,311	31	24	7	2	3	*	3	*	19	18	7
2087.....	2,430	209	14	2	*	1	*	*	*	7	2	1
209.....	36,615	925	299	68	11	10	3	47	8	171	142	59
2091.....	1,410	23	13	2	*	*	-	2	*	9	4	2
2094.....	3,634	57	67	8	1	*	1	5	1	31	10	8
21.....	19,542	660	15	1	1	*	*	*	1	15	14	1
22.....	239,831	1,837	431	111	69	82	7	10	13	224	228	103
2211.....	86,273	542	75	19	14	13	1	2	4	50	54	17
2221.....	24,968	194	42	6	3	4	*	1	1	30	11	6
2231.....	20,703	194	57	17	10	14	1	*	2	23	18	16
225.....	22,971	147	50	5	3	4	*	1	1	20	49	5
2251.....	5,870	33	6	1	*	*	-	*	*	3	1	1
226.....	37,799	315	103	48	32	39	3	2	4	42	55	45
2261.....	25,567	210	48	31	23	25	3	1	2	27	37	29
2262.....	9,858	85	40	15	8	12	1	*	2	14	16	14
2269.....	2,374	19	15	2	1	1	*	*	*	1	2	2
227.....	12,314	129	20	4	2	3	1	*	1	13	19	4
228.....	13,672	93	30	5	3	2	1	*	1	22	8	4
2281.....	4,620	26	11	2	1	*	1	*	*	9	4	2
2284.....	2,794	23	7	1	1	1	-	*	*	4	1	1
229.....	19,360	210	50	6	1	2	*	3	1	23	13	6
2421.....	36,051	279	93	113	8	33	56	5	19	66	157	93
243.....	17,317	168	53	12	2	2	6	1	3	35	19	10
2431.....	2,974	20	6	1	*	*	*	*	*	4	1	*
2432.....	14,343	149	47	11	1	2	6	1	3	31	18	10
26.....	225,197	3,492	593	1,863	854	1,232	348	172	112	531	5,107	1,765
2621.....	101,863	1,466	253	955	454	639	194	61	61	233	2,295	906
2631.....	54,181	1,035	167	560	224	327	126	78	29	158	1,739	526
264.....	29,986	396	68	36	13	17	8	7	5	45	96	34
2654.....	12,881	178	15	1	*	*	-	*	1	12	5	1
28.....	420,897	11,257	940	2,954	623	520	583	1,681	170	709	6,374	2,749
281.....	166,130	4,162	452	2,345	503	419	523	1,297	106	341	4,993	2,230
2812.....	15,195	291	25	400	30	13	95	260	33	21	487	386
2815.....	20,232	426	45	100	40	8	1	85	7	38	252	94
2818.....	61,318	1,834	122	1,316	333	310	318	657	31	92	2,905	1,272
2819.....	57,468	1,293	173	412	75	70	101	212	29	129	1,127	367
282.....	111,784	2,572	143	325	73	39	39	224	23	112	782	307
2821.....	41,863	923	99	163	34	17	13	125	9	76	401	151
2823.....	6,786	92	6	41	12	7	5	26	3	4	63	40
283.....	62,629	2,125	67	58	6	4	6	42	5	57	112	34
289.....	23,835	465	98	61	14	21	3	28	9	76	104	48
2899.....	9,730	241	45	26	5	3	2	17	4	38	54	23
29.....	115,949	3,015	251	1,375	166	87	84	1,108	97	215	6,084	1,296
2911.....	108,529	2,897	201	1,365	165	82	81	1,106	96	185	6,070	1,288
30.....	193,818	2,434	248	116	23	16	18	68	14	184	248	110
3021.....	16,586	145	8	3	*	*	1	1	*	6	4	3
3031.....	1,328	19	5	2	*	*	-	2	*	2	2	2
3079.....	27,314	305	86	25	5	4	*	19	3	52	48	24
31.....	20,707	188	66	11	1	10	*	*	1	29	13	10
3111.....	14,912	138	63	11	1	9	*	*	1	28	13	10
32.....	173,180	2,646	459	223	44	78	81	44	21	284	341	193
322.....	52,151	608	73	11	4	4	*	5	2	49	34	11
3221.....	34,416	373	47	6	3	2	*	3	1	31	11	5
3229.....	17,735	235	26	5	1	2	*	2	1	18	23	6
3241.....	25,464	570	124	106	9	14	62	22	8	78	141	85
326.....	10,996	101	19	2	*	1	*	1	*	13	5	2
327.....	14,829	260	101	16	1	12	-	1	3	47	24	12

Table 2B.--NON-APPALACHIA--WATER INTAKE BY PURPOSE, GROSS WATER USED, AND WATER DISCHARGED, BY INDUSTRY GROUPS, AND INDUSTRIES: 1964--Con.

Code	Establishments reporting consumption of water			Water intake by purpose					Boiler feed, sanitary service, and other uses (billion gallons)	Establishments recirculating or reusing water (number)	Gross water used, including recirculation or reuse (billion gallons)	Total water discharged (billion gallons)
				All purposes			Cooling and condensing					
	All employees (number)	Value added by manufacture adjusted (million dollars)	Total (number)	Total (billion gallons)	Treated prior to use (billion gallons)	Process (billion gallons)	Steam electric power generation (billion gallons)	Other (billion gallons)				
329.....	47,937	732	102	49	23	35	1	8	4	70	69	45
3291.....	16,731	288	15	4	*	1	*	2	1	9	5	4
33.....	590,323	8,543	621	3,226	537	698	1,018	1,407	103	460	4,841	3,045
331.....	345,165	5,335	196	2,746	443	594	760	1,321	71	161	3,962	2,586
3312.....	317,444	4,959	121	2,700	440	579	750	1,302	69	110	3,901	2,542
3317.....	9,107	115	20	8	*	7	-	1	1	17	13	8
332.....	68,705	735	107	23	2	10	*	8	5	63	35	21
3321.....	39,914	434	54	16	1	9	*	5	2	25	24	15
333.....	35,304	775	64	354	81	53	243	40	17	57	665	340
3331.....	9,337	213	21	32	3	17	3	11	2	18	161	26
3332.....	1,986	37	6	5	*	*	*	3	1	6	10	4
335.....	97,554	1,203	147	74	9	35	8	25	6	114	123	71
3352.....	23,335	273	32	19	1	6	*	12	1	22	28	19
3356.....	7,986	99	13	10	*	5	-	4	1	11	17	10
3369.....	3,476	37	10	1	*	1	-	*	*	7	9	1
339.....	26,422	287	53	19	2	2	6	9	2	33	33	18
34.....	225,762	2,838	419	52	5	28	1	14	9	229	116	47
342.....	56,650	840	61	13	1	8	1	3	2	40	27	12
3421.....	5,034	128	6	2	*	*	*	1	*	5	4	2
344.....	36,940	394	62	12	1	6	*	5	1	37	34	10
3461.....	29,045	334	51	6	1	3	*	2	1	28	27	6
349.....	33,376	434	60	5	1	1	*	2	1	34	7	5
3494.....	20,564	255	29	2	*	1	*	1	1	18	3	2
35.....	490,067	6,179	364	151	11	22	58	51	21	234	277	143
3522.....	59,800	728	38	38	1	4	27	3	3	23	45	36
3531.....	60,562	815	32	7	3	4	*	2	2	23	32	7
354.....	47,966	570	47	4	*	1	*	1	2	24	5	4
3541.....	25,537	268	19	2	*	*	*	*	1	12	2	2
3544.....	4,369	62	7	1	*	*	-	*	1	3	1	1
356.....	78,861	960	77	16	1	2	3	8	3	51	37	16
3561.....	17,630	210	21	8	*	*	3	3	1	13	9	8
357.....	65,877	771	21	13	1	1	2	7	2	16	35	12
3599.....	11,471	149	16	2	*	1	-	1	*	13	3	2
36.....	727,540	8,807	409	88	14	25	7	34	22	303	235	74
361.....	45,736	607	36	7	1	2	1	3	1	31	15	6
362.....	63,033	775	55	14	3	2	*	6	5	39	21	13
3622.....	10,358	153	8	1	*	*	*	*	*	6	2	1
3632.....	39,976	613	14	11	1	4	*	6	1	10	17	5
3639.....	4,878	88	6	1	*	*	-	*	*	4	1	1
364.....	38,522	485	48	5	*	3	*	2	1	29	7	5
3643.....	15,266	181	16	2	*	1	*	*	*	12	2	2
366.....	298,291	3,417	69	18	3	3	5	5	5	60	77	17
367.....	114,858	1,094	80	11	3	3	*	4	3	61	56	10
3679.....	45,359	426	37	4	1	2	*	1	1	25	7	4
3691.....	6,302	96	20	2	*	1	-	1	*	15	4	2
37.....	1,170,086	18,304	394	238	30	53	11	89	85	297	643	229
371.....	541,240	10,789	234	124	17	38	1	19	66	183	417	119
372.....	520,235	6,473	104	93	13	13	5	64	10	89	200	89
3729.....	103,901	1,238	43	12	4	4	2	3	2	38	27	11
374.....	20,385	248	14	5	*	*	1	3	1	5	6	5
3751.....	6,604	55	8	1	*	1	-	*	*	6	2	1
38.....	138,306	2,019	90	26	11	12	3	4	7	72	68	24
3811.....	15,136	183	10	1	*	*	-	*	*	6	2	1
387.....	16,623	164	11	1	*	*	*	*	1	10	3	1
3871.....	16,623	164	11	1	*	*	*	*	1	10	3	1
39.....	41,014	502	69	12	2	5	3	4	1	35	21	11
398.....	8,406	153	10	2	1	*	*	2	*	5	9	2

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

*Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 2C.--WATER INTAKE BY PURPOSE, GROSS WATER USED, AND WATER DISCHARGED, FOR APPALACHIA, BY STATES AND MAJOR INDUSTRY GROUPS: 1964

State and major industry group	Code	Establishments reporting consumption of water			Water intake by purpose					Boiler feed, sanitary service, and other uses (billion gallons)	Establishments recirculating or reusing water (number)	Gross water used, including recirculation or reuse (billion gallons)	Total water discharged (billion gallons)
					All purposes			Cooling and condensing					
		All employees (1,000)	Value added by manufacture adjusted (million dollars)	Total (number)	Total (billion gallons)	Treated prior to use (billion gallons)	Process (billion gallons)	Steam electric power generation (billion gallons)	Other (billion gallons)				
Appalachia, total		745	9,914	1,010	2,686	412	515	516	1,500	155	656	4,468	2,546
NEW YORK.....		55	596	74	28	5	9	*	15	4	42	39	27
	20	2	38	20	2	*	*	-	1	1	12	3	3
	28	3	76	8	11	2	2	-	8	1	3	13	11
	33	3	27	4	2	*	*	-	1	*	2	6	1
	35	20	161	9	2	1	1	*	*	1	6	4	2
	36	16	170	8	1	*	1	-	1	*	4	2	1
PENNSYLVANIA..		277	3,468	343	1,035	179	225	257	475	78	220	1,892	982
	20	9	189	36	3	1	1	*	1	1	23	7	3
	22	5	35	9	1	*	1	-	*	*	5	1	1
	26	6	68	11	56	26	34	18	2	1	10	565	47
	28	9	153	28	102	3	3	18	77	4	20	137	100
	29	2	28	11	12	1	1	-	10	1	9	27	11
	30	4	49	17	2	1	1	*	1	*	9	3	2
	31	1	7	4	1	1	1	*	*	*	4	1	1
	32	18	204	40	11	2	5	*	5	1	22	16	10
	33	133	1,676	86	821	142	171	212	373	65	56	1,088	783
	34	17	192	30	3	*	1	*	*	1	16	3	3
	36	33	406	29	12	1	1	8	2	1	19	20	12
	37	17	221	12	7	1	4	1	1	1	9	16	6
OHIO.....		42	591	75	295	23	28	79	181	7	44	389	288
	20	1	15	10	1	*	*	*	*	*	5	1	1
	28	2	48	9	68	2	10	7	50	1	4	82	67
	30	2	19	5	1	*	*	-	1	*	2	1	1
	32	4	34	8	1	*	*	-	1	*	4	1	1
	33	21	303	21	206	6	8	65	128	5	18	230	205
	34	2	27	7	1	1	1	*	*	*	2	1	1
MARYLAND.....		13	154	13	47	11	9	17	20	2	9	58	46
	20	*	5	5	*	*	*	*	*	*	3	1	*
VIRGINIA.....		10	124	17	37	2	2	1	33	1	12	43	36
WEST VIRGINIA.		61	1,433	84	678	31	86	95	475	22	60	817	670
	28	22	769	31	477	23	13	26	430	8	27	559	468
NORTH CAROLINA		59	918	61	79	35	34	*	40	5	40	129	78
	20	2	20	5	1	*	1	-	*	*	3	1	1
	22	24	184	33	6	4	6	*	*	1	21	11	6
	36	8	77	6	1	*	1	-	*	*	4	2	1
SOUTH CAROLINA		45	317	67	10	4	6	*	2	1	46	44	8
	22	36	237	48	7	4	5	*	1	1	31	35	6
GEORGIA.....		25	250	56	25	13	14	5	5	2	37	67	24
	20	2	15	9	2	*	1	-	1	*	6	2	2
	22	17	149	33	8	4	5	2	*	1	20	15	8
KENTUCKY.....		6	100	13	34	4	13	*	19	2	8	101	31
TENNESSEE.....		65	895	88	228	63	32	30	147	18	58	458	212
	20	3	31	14	1	*	*	-	1	*	9	8	1
	22	11	79	16	8	4	4	*	3	1	11	12	8
	28	24	482	16	155	34	7	14	122	12	10	264	149
	32	4	46	12	2	*	1	-	1	*	4	3	1
	36	4	38	4	*	*	*	-	*	*	2	3	*
ALABAMA.....		86	1,067	119	190	42	59	34	88	11	80	432	144
	20	2	21	13	2	*	1	*	*	*	8	2	1
	22	17	113	26	4	3	3	*	*	1	18	8	3
	28	4	123	15	54	4	4	3	46	1	9	58	52
	33	35	444	26	91	5	35	16	34	7	22	250	47

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

* Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 3A.--APPALACHIA--WATER INTAKE BY SOURCE, GROSS WATER USED, AND TREATED AND DISCHARGED BY DISCHARGE POINT, BY INDUSTRY GROUPS AND INDUSTRIES: 1964

(In billion gallons except value)

Code	Value of shipments ($ million)	Water intake by source						Gross water used, including recirculation or reuse	Water treated and discharged												
		Total	Fresh water				Brackish water		Total dis-charged	Amount treated prior to dis-charge	Point of discharge										
			Total	From public water systems	From company water systems						Public utility sewer			Surface water body			Ground (wells, spray, etc.)			Trans-ferred to other users
					Surface	Ground					Total	All treated	Part treated	Total	All treated	Part treated	Total	All treated	Part treated	
U.S. total.....	213,960	14,046	11,210	1,383	8,466	1,360	2,836	30,598	13,157	3,825	986	31	271	11,759	389	6,179	195	*	83	217
Appalachia total	20,947	2,686	2,678	132	2,438	108	8	4,468	2,546	458	128	7	65	2,398	9	1,670	17	-	7	4
20.....	1,057	13	13	8	1	4	*	25	12	2	6	1	1	4	*	1	1	-	*	*
201.....	289	4	4	3	*	1	-	4	3	1	3	*	-	1	-	*	*	-	-	*
2015.....	204	3	3	2	*	*	-	3	3	1	2	*	-	*	-	*	*	-	-	*
202.....	217	4	4	1	*	2	-	7	4	*	1	*	*	2	*	1	*	-	*	*
2023.....	(D)	1	1	*	*	1	-	2	1	*	*	*	-	1	*	*	*	-	*	-
2026.....	163	2	2	1	*	1	-	5	3	*	1	*	*	1	-	*	*	-	-	*
203.....	219	2	2	2	*	*	-	3	2	1	1	*	*	1	*	*	*	-	-	-
2033.....	160	1	1	1	*	*	-	2	1	*	1	-	*	*	*	*	*	-	-	-
208.....	139	2	2	2	*	*	-	4	2	*	1	-	*	1	-	*	*	-	*	-
2082.....	66	1	1	1	-	*	-	3	1	*	1	-	*	*	-	-	-	-	-	-
209.....	101	1	1	*	*	*	*	6	1	*	*	*	*	1	-	-	*	-	-	*
2094.....	3	1	*	*	*	*	*	1	1	*	*	-	-	1	-	-	*	-	-	-
21.....	1,009	1	1	1	-	*	-	5	2	*	1	-	1	*	-	*	-	-	-	1
22.....	2,075	36	36	14	16	6	-	83	32	9	10	*	1	18	2	3	3	-	3	*
2211.....	642	8	8	2	4	2	-	33	6	1	1	*	*	5	-	*	*	-	*	-
2221.....	429	4	4	2	1	*	-	15	3	1	1	*	*	2	1	-	*	-	-	-
2231.....	66	1	1	1	1	*	-	2	1	*	1	-	-	1	-	-	*	-	-	-
225.....	233	2	2	1	*	*	-	5	1	1	1	-	*	*	-	*	*	-	*	*
2251.....	91	*	*	*	*	*	-	3	*	-	*	-	-	*	-	-	-	-	-	-
226.....	175	10	10	4	6	*	-	12	9	2	3	-	*	6	1	1	*	-	*	*
2261.....	73	6	6	2	4	*	-	7	5	1	1	-	-	4	1	1	*	-	-	*
2262.....	26	2	2	1	2	*	-	3	2	2	1	-	-	1	-	-	-	-	-	-
2269.....	76	2	2	2	*	*	-	2	2	*	2	-	*	*	-	*	*	-	*	*
227.....	236	3	3	2	1	*	-	4	3	1	2	-	*	1	1	*	*	-	-	-
228.....	165	2	2	1	1	*	-	5	2	1	1	-	1	1	-	*	-	-	-	-
2281.....	72	1	1	*	*	*	-	2	*	*	*	-	-	*	-	-	-	-	-	-
2284.....	73	2	2	1	*	*	-	3	1	1	1	-	1	1	-	-	-	-	-	-
229.....	110	6	6	*	2	3	-	8	6	2	*	-	*	2	-	2	3	-	3	-
26.....	702	207	207	6	181	20	-	919	182	86	9	2	4	173	2	133	*	-	*	-
2621.....	528	183	183	4	166	13	-	800	161	78	6	2	4	155	1	117	*	-	*	-
2631.....	114	17	17	1	15	2	-	106	16	8	2	*	*	15	*	12	*	-	-	-
264.....	38	6	6	*	*	5	-	10	4	*	*	*	*	4	*	4	*	-	*	-
28.....	3,019	934	929	30	876	24	5	1,203	913	98	24	4	3	881	2	594	7	-	2	*
281.....	1,585	675	672	23	635	14	3	834	658	75	12	4	1	642	2	441	3	-	*	*
2812.....	136	128	128	6	118	4	-	140	123	37	*	-	*	123	-	104	-	-	-	-
2815.....	151	7	7	1	1	6	-	24	6	4	*	-	*	5	*	3	*	-	*	*
2818.....	868	392	390	3	385	2	2	413	388	14	4	4	*	384	-	280	*	-	-	*
2819.....	359	87	86	5	79	2	2	185	80	19	2	-	1	79	-	53	-	-	-	*
282.....	1,144	204	203	2	192	9	1	311	202	21	11	-	1	187	*	125	4	-	2	*
2821.....	391	55	55	1	51	3	-	70	55	1	9	-	*	44	*	16	2	-	2	*
2823.....	468	111	111	1	105	5	-	170	110	16	1	-	1	107	-	86	2	-	*	-
283.....	119	7	7	*	7	*	-	9	7	1	*	-	*	7	-	7	*	-	-	-
289.....	108	33	33	3	29	*	-	34	32	1	*	-	*	32	-	22	*	-	*	*
2899.....	44	10	10	3	7	-	-	10	10	*	*	-	*	10	-	-	*	-	*	*
29.....	318	23	23	1	17	5	-	77	21	13	*	-	*	21	2	9	*	-	*	*
2911.....	300	22	22	*	17	5	-	77	21	13	*	-	*	21	2	9	*	-	*	*
30.....	479	47	47	3	42	2	-	88	45	3	1	-	*	43	-	6	*	-	-	*
3079.....	97	3	3	1	1	1	-	4	3	*	*	-	-	2	-	*	*	-	-	-
31.....	98	5	5	1	1	3	-	5	5	1	1	-	-	4	*	-	*	-	-	-
3111.....	81	5	5	1	1	3	-	5	5	1	1	-	-	4	*	-	*	-	-	-
32.....	835	25	25	7	13	5	*	47	25	5	2	*	1	20	-	5	1	-	*	2
322.....	339	5	5	3	*	1	-	13	5	3	1	*	1	4	-	*	*	-	-	*
3241.....	129	8	8	1	5	2	-	10	10	*	*	-	*	7	-	2	*	-	*	2
325.....	22	*	*	*	-	*	-	1	*	*	*	-	*	*	-	*	*	-	-	-
326.....	61	1	1	*	-	*	-	1	1	*	*	*	*	*	-	*	-	-	-	-
327.....	12	1	1	*	1	*	-	1	1	*	*	-	-	1	-	-	*	-	-	-
329.....	45	2	2	*	1	1	-	3	1	*	*	*	-	1	-	-	*	-	-	-
3291.....	13	1	1	*	*	*	-	1	1	-	*	-	-	1	-	-	-	-	-	-

Table 3A.--APPALACHIA--WATER INTAKE BY SOURCE, GROSS WATER USED, AND TREATED AND DISCHARGED BY DISCHARGE POINT, BY INDUSTRY GROUPS AND INDUSTRIES: 1964--Con.

(In billion gallons except value)

Code	Value of shipments ($ millions)	Water intake by source						Gross water used, including recirculation or reuse	Water treated and discharged												
		Total	Fresh water				Brackish water		Total discharged	Amount treated prior to discharge	Point of discharge										
			Total	From public water systems	From company water systems						Public utility sewer			Surface water body			Ground(wells, spray, etc.)			Transferred to other users
					Surface	Ground					Total	All treated	Part treated	Total	All treated	Part treated	Total	All treated	Part treated	
33.....	7,247	1,352	1,352	41	1,281	30	*	1,938	1,267	237	58	*	51	1,207	-	914	2	-	1	*
331.....	5,720	1,305	1,305	32	1,255	18	-	1,843	1,224	209	55	*	50	1,167	-	906	1	-	1	*
3312.....	5,345	1,114	1,114	31	1,068	16	-	1,609	1,034	167	55	*	50	978	-	789	1	-	1	*
3317.....	115	4	4	*	3	1	-	5	3	1	*	-	*	3	-	*	*	-	*	*
332.....	327	5	5	3	1	1	*	10	4	*	1	*	*	3	-	1	*	-	*	*
3321.....	221	4	4	2	1	1	-	6	3	*	1	*	*	2	-	*	*	-	*	*
333.....	314	32	32	3	24	5	-	39	30	28	*	*	*	29	-	3	1	-	*	*
335.....	802	9	9	3	1	6	-	44	8	1	1	-	*	7	-	4	*	-	*	-
3352.....	507	4	4	2	*	3	-	36	4	*	*	-	*	4	-	2	*	-	*	-
3356.....	163	3	3	*	1	2	-	3	2	*	*	-	*	2	-	1	-	-	-	-
34.....	698	6	6	3	*	2	-	7	5	*	2	-	*	3	*	1	*	-	*	*
342.....	51	1	1	*	*	*	-	1	1	*	*	-	-	*	-	*	*	-	*	-
344.....	190	2	2	*	-	1	-	2	2	*	1	-	*	1	*	*	-	-	-	-
3461.....	164	1	1	1	-	*	-	1	1	*	*	-	*	1	*	*	*	-	*	-
349.....	140	1	1	1	*	*	-	1	1	*	*	-	-	*	-	*	*	-	-	-
3494.....	89	1	1	*	*	*	-	1	*	-	*	-	-	*	-	-	*	-	-	-
35.....	780	6	5	3	*	2	1	10	6	1	4	*	*	2	*	1	1	-	*	-
354.....	162	2	1	1	*	*	1	3	2	*	1	-	*	*	*	*	1	-	*	-
355.....	49	*	*	*	-	*	-	1	*	*	*	-	*	*	-	*	-	-	-	-
356.....	178	1	1	*	*	1	-	2	1	*	*	-	*	1	-	*	*	-	-	-
3561.....	118	1	1	*	*	*	-	1	*	-	*	-	-	*	-	-	*	-	-	-
357.....	239	2	2	1	-	1	-	3	2	*	2	-	-	*	*	-	*	-	-	-
36.....	1,432	17	17	7	9	2	*	31	17	2	3	-	1	13	*	2	1	-	*	*
361.....	311	4	4	1	3	*	-	7	4	*	*	-	*	4	*	*	*	-	*	-
362.....	215	7	7	2	5	*	*	12	7	*	1	-	*	6	*	1	*	-	-	-
364.....	187	2	2	1	-	*	-	2	1	*	1	-	*	*	-	*	*	-	-	*
366.....	398	1	1	1	-	-	-	5	1	*	1	-	*	*	*	*	-	-	-	-
367.....	270	3	3	1	*	1	-	5	3	1	1	-	*	2	-	1	*	-	*	-
3679.....	163	2	2	1	*	1	-	2	2	1	1	-	*	1	-	*	*	-	*	-
37.....	885	8	7	5	*	1	2	19	8	1	4	*	3	4	-	2	*	-	*	-
371.....	342	3	2	1	*	1	1	5	2	1	1	-	*	2	-	1	-	-	-	-
3717.....	342	3	2	1	*	1	1	5	2	1	1	-	*	2	-	1	-	-	-	-
372.....	150	3	3	3	-	-	-	4	3	*	3	*	3	*	-	*	*	-	*	-
374.....	375	3	2	1	*	*	1	11	2	*	*	-	*	2	-	2	-	-	-	-
38.....	156	3	3	1	*	2	-	7	2	*	2	-	*	*	-	*	-	-	-	-
39.....	41	1	1	1	-	-	-	1	1	*	*	-	*	*	-	*	*	-	-	-

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

* Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 3B.--NON-APPALACHIA--WATER INTAKE BY SOURCE, GROSS WATER USED, AND TREATED AND DISCHARGED BY DISCHARGE POINT, BY INDUSTRY GROUPS AND INDUSTRIES: 1964

(In billion gallons except value)

Code	Value of shipments ($ millions)	Water intake by source						Gross water used, including recirculation or reuse	Water treated and discharged												
		Total	Fresh water				Brackish water		Total dis-charged	Amount treated prior to dis-charge	Point of discharge										
			Total	From public water systems	From company water systems						Public utility sewer			Surface water body			Ground (wells, spray, etc.)			Trans-ferred to other users
					Surface	Ground					Total	All treated	Part treated	Total	All treated	Part treated	Total	All treated	Part treated	
Non-Appalachia total.....	193,013	11,360	8,531	1,251	6,028	1,252	2,828	26,130	10,611	3,367	859	24	206	9,361	380	4,509	178	*	76	213
20.....	30,344	746	668	184	214	270	79	1,254	676	156	235	14	35	348	10	103	78	*	28	15
201.....	9,037	102	102	50	3	48	*	161	95	38	67	12	14	26	*	12	2	-	1	*
2015.....	819	14	14	9	*	5	*	16	14	2	8	*	1	5	*	*	1	-	*	*
202.....	3,685	58	58	21	5	32	*	97	54	9	35	*	3	16	*	3	3	-	-	*
2021.....	252	8	8	1	*	6	-	10	7	1	4	*	1	3	-	1	*	-	*	*
2023.....	(D)	16	16	2	4	11	-	29	16	2	7	*	1	9	*	1	*	-	*	*
2026.....	2,192	28	28	15	1	12	*	45	26	6	22	*	1	2	-	*	2	-	*	*
203.....	4,001	90	85	33	5	47	5	150	85	30	38	1	5	34	2	14	12	*	5	1
2031.....	169	2	1	1	*	*	1	2	2	*	1	-	*	1	-	*	*	-	-	-
2033.....	1,551	34	31	14	*	17	2	49	31	13	18	1	1	9	*	1	4	-	1	1
2035.....	325	3	2	2	*	1	1	5	3	1	1	*	*	2	*	1	*	-	-	*
2036.....	69	1	1	1	-	*	*	1	1	*	*	-	-	*	-	-	*	-	-	-
2043.....	552	5	5	1	1	3	*	5	3	1	2	-	1	1	-	-	-	-	-	-
2046.....	601	48	42	3	30	10	6	72	42	4	12	*	2	30	-	16	*	-	*	-
206.....	1,989	242	194	15	127	51	48	412	220	55	3	-	1	151	7	34	55	-	21	11
2061.....	294	123	104	10	59	36	19	252	113	19	1	-	*	49	*	13	53	-	20	10
2062.....	1,145	65	39	4	34	1	26	74	59	2	1	-	*	57	*	10	1	-	1	*
2063.....	550	54	51	2	34	15	3	86	49	34	1	-	1	46	7	12	1	-	*	1
208.....	3,970	106	103	38	26	39	4	168	92	7	48	1	5	40	-	10	3	-	1	1
2082.....	2,089	57	54	27	14	13	3	91	50	5	31	1	4	18	-	5	*	-	*	*
2083.....	124	7	7	1	*	6	-	18	7	1	4	*	*	3	-	1	*	-	-	-
2087.....	388	2	1	1	*	*	*	2	1	*	*	-	*	1	-	*	-	-	-	-
209.....	3,538	68	55	14	11	30	12	142	59	11	22	*	4	34	1	13	2	-	*	1
2091.....	109	2	2	*	*	2	-	4	2	*	*	-	-	1	-	-	*	-	-	*
2094.....	121	8	8	1	3	4	*	10	8	2	2	-	*	5	*	1	1	-	-	*
2095.....	705	2	2	1	*	1	-	6	2	-	1	-	-	1	-	-	*	-	-	*
21.....	1,499	1	1	1	-	-	-	14	1	*	1	-	*	*	-	-	-	-	-	-
22.....	4,769	111	110	32	68	10	1	228	103	26	33	2	3	68	6	5	1	-	1	*
2211.....	1,313	19	19	5	13	1	*	54	17	5	5	1	*	11	2	1	*	-	-	*
2221.....	485	6	6	4	1	*	*	11	6	1	2	-	1	3	*	*	*	-	*	*
2231.....	524	17	17	3	12	1	-	18	16	4	2	*	*	14	-	1	*	-	-	-
225.....	385	5	5	3	1	1	-	49	5	1	3	-	*	2	*	*	*	-	-	*
226.....	828	48	47	10	35	3	1	55	45	10	15	*	1	29	3	*	1	-	*	*
2261.....	605	31	31	3	26	2	-	37	29	7	8	*	*	20	3	*	1	-	*	*
2262.....	176	15	14	6	8	1	1	16	14	3	5	-	*	8	1	-	*	-	-	*
2269.....	46	2	2	1	1	*	-	2	2	*	1	-	*	*	*	-	-	-	-	-
227.....	356	4	4	1	2	1	-	19	4	1	2	-	*	2	*	1	1	-	-	-
228.....	292	5	5	1	3	1	-	8	4	1	1	*	*	3	*	1	*	-	-	-
2281.....	71	2	2	*	2	*	-	4	2	*	*	*	-	2	*	-	*	-	-	-
2284.....	52	1	1	1	*	*	-	1	1	*	1	*	-	*	-	-	*	-	-	-
229.....	555	6	6	3	2	1	*	13	6	2	2	-	*	4	*	1	*	-	*	*
2297.....	73	1	1	*	1	1	-	1	1	1	*	-	*	1	-	*	*	-	*	-
242.....	581	114	94	3	77	14	20	157	93	30	2	*	1	87	2	34	2	-	*	1
243.....	363	12	7	2	4	1	5	19	10	*	2	*	1	8	*	2	*	-	*	*
2431.....	43	1	1	*	-	*	-	1	*	-	*	-	-	*	-	-	*	-	-	-
2432.....	320	11	7	2	4	1	5	18	10	*	1	*	1	8	*	2	*	-	*	*
244.....	19	1	1	*	*	*	-	1	*	-	*	-	-	*	-	-	*	-	-	-
26.....	7,166	1,863	1,711	223	1,142	346	152	5,107	1,765	620	72	2	11	1,649	43	814	11	-	5	33
2621.....	3,047	955	913	104	680	130	42	2,295	906	296	37	-	6	848	31	458	2	-	1	18
2631.....	2,015	560	467	50	306	111	93	1,739	526	234	22	2	4	487	8	235	8	-	4	10
264.....	927	36	36	5	22	9	*	96	34	9	4	*	*	29	1	7	*	-	*	1
2654.....	325	1	1	*	-	1	*	5	1	*	1	-	*	*	-	*	*	-	*	-
28.....	18,973	2,954	1,619	243	1,076	300	1,335	6,374	2,749	482	129	3	46	2,503	12	923	31	-	19	87
281.....	7,425	2,345	1,128	176	805	147	1,217	4,993	2,230	346	91	1	34	2,037	9	659	19	-	9	82
2812.....	499	400	172	47	101	23	229	487	386	91	21	-	19	361	-	94	2	-	-	2
2815.....	820	100	66	12	45	9	34	252	94	44	11	1	1	84	-	64	*	-	*	*
2818.....	3,328	1,316	455	60	357	38	861	2,905	1,272	100	30	*	5	1,163	6	317	7	-	1	72
2819.....	2,269	412	369	33	270	67	43	1,127	367	84	12	*	8	338	3	145	10	-	8	7
282.....	4,444	325	296	38	216	42	29	782	307	98	13	1	4	286	3	164	5	-	5	3
2821.....	2,402	163	136	17	99	19	28	401	151	39	11	1	3	138	1	66	*	-	*	2
2823.....	189	41	41	1	37	3	*	63	40	6	*	-	-	40	-	37	*	-	*	-
283.....	2,700	58	36	10	10	16	22	112	34	5	9	1	3	22	*	11	3	-	3	*

Table 3B.--NON-APPALACHIA--WATER INTAKE BY SOURCE, GROSS WATER USED, AND TREATED AND DISCHARGED BY DISCHARGE POINT, BY INDUSTRY GROUPS AND INDUSTRIES: 1964--Con.

(In billion gallons except value)

Code	Value of shipments ($ millions)	Water intake by source						Gross water used, including recirculation or reuse	Water treated and discharged													
		Total	Fresh water				Brackish water		Total dis-charged	Amount treated prior to dis-charge	Point of discharge											Trans-ferred to other users
			Total	From public water systems	From company water systems						Public utility sewer			Surface water body			Ground (wells, spray, etc.)					
					Surface	Ground					Total	All treated	Part treated	Total	All treated	Part treated	Total	All treated	Part treated			
2831	29	1	1	*	-	*	-	2	*	*	*	-	-	*	-	-	-	-	-	-		
2879	97	2	1	1	*	1	1	8	1	*	*	-	*	1	*	1	-	-	-	*		
289	852	61	58	7	22	30	3	104	48	9	6	1	3	41	*	18	1	-	*	*		
2899	443	26	23	4	11	8	3	54	23	4	3	*	1	21	*	7	*	-	*	*		
29	15,780	1,375	688	129	467	92	688	6,084	1,296	993	30	2	22	1,219	243	258	5	-	2	42		
2911	15,465	1,365	678	127	461	89	687	6,070	1,288	992	27	2	21	1,214	243	254	4	-	2	42		
30	4,840	116	115	26	56	33	1	248	110	6	23	*	8	84	*	23	2	-	*	*		
3021	226	3	3	*	2	*	-	4	3	*	*	*	*	2	-	1	*	-	*	-		
3031	33	2	2	*	1	1	-	2	2	*	*	-	*	2	-	1	*	-	*	-		
3079	567	25	25	5	5	14	*	48	24	3	7	-	3	17	-	1	1	-	*	*		
31	419	11	11	5	4	2	*	13	10	6	6	-	*	4	1	1	*	-	*	*		
3111	337	11	10	5	4	2	*	13	10	6	6	-	*	4	1	1	*	-	*	*		
32	4,251	223	184	25	122	37	39	341	193	36	17	*	3	157	7	47	17	-	11	2		
322	894	11	11	6	*	5	*	34	11	2	5	*	1	5	1	1	*	-	*	1		
3241	862	106	91	3	76	12	15	141	85	2	1	*	*	83	-	14	1	-	*	1		
325	33	1	1	*	*	*	-	1	1	*	*	-	*	*	*	*	*	-	-	*		
326	151	2	1	1	*	*	1	5	2	*	1	-	*	*	*	*	*	-	-	*		
327	463	16	15	2	5	9	1	24	12	4	1	*	*	10	*	1	2	-	*	*		
329	1,285	49	26	7	9	10	22	69	45	20	8	*	1	23	3	5	14	-	11	*		
3291	455	4	4	2	1	2	-	5	4	*	3	*	*	*	-	-	-	-	-	-		
3297	62	4	1	1	*	*	3	5	4	3	*	-	-	3	3	-	-	-	-	*		
33	19,744	3,226	2,798	125	2,599	75	428	4,841	3,045	941	99	*	22	2,896	39	2,149	18	-	6	31		
331	11,417	2,746	2,461	62	2,362	37	285	3,962	2,586	895	46	*	15	2,521	35	2,112	15	-	5	4		
3312	10,327	2,700	2,416	50	2,332	33	285	3,901	2,542	874	33	-	13	2,491	29	2,094	13	-	5	4		
3317	335	8	8	7	1	1	-	13	8	*	7	-	*	1	-	*	*	-	*	*		
332	1,175	23	23	10	10	3	-	35	21	4	13	-	1	8	3	*	*	-	*	*		
3321	725	16	16	6	9	2	-	24	15	3	9	-	1	6	3	*	*	-	*	*		
333	2,277	354	227	8	196	23	127	665	340	24	4	*	*	310	*	25	1	-	*	24		
3331	956	32	19	5	8	6	13	161	26	8	1	*	*	18	-	5	1	-	-	6		
3332	170	5	4	*	1	3	1	10	4	*	*	-	*	2	-	1	*	-	*	1		
335	3,733	74	70	32	28	10	4	123	71	17	26	-	5	41	*	10	1	-	*	2		
3352	852	19	18	3	10	4	2	28	19	10	3	-	1	16	*	6	1	-	*	-		
3356	222	10	10	10	*	*	*	17	10	1	8	-	1	1	-	1	*	-	-	1		
3369	61	1	1	1	-	*	-	9	1	*	1	-	1	*	*	*	*	-	*	*		
34	5,224	52	50	34	7	9	2	116	47	9	30	-	5	16	1	9	1	-	*	*		
342	1,287	13	11	10	*	1	2	27	12	2	8	-	1	4	*	2	*	-	-	*		
3421	168	2	1	1	-	*	1	4	2	*	1	-	-	1	*	-	-	-	-	-		
344	845	12	12	5	7	1	-	34	10	5	3	-	1	7	*	5	*	-	*	*		
3461	669	6	6	5	*	1	*	27	6	*	4	-	1	1	-	1	*	-	-	*		
349	775	5	5	3	*	2	-	7	5	1	3	-	1	1	*	-	*	-	*	*		
3494	418	2	2	2	*	*	-	3	2	*	2	-	1	*	*	-	*	-	*	*		
35	11,054	151	124	39	71	13	27	277	143	11	37	*	7	104	5	55	1	-	*	1		
3522	1,498	38	36	7	27	2	2	45	36	6	4	-	1	31	4	17	*	-	*	*		
3531	1,597	7	7	3	3	1	-	32	7	*	4	-	1	3	-	3	*	-	*	*		
354	818	4	4	3	*	1	-	5	4	*	2	-	*	1	*	*	*	-	-	*		
3544	79	1	1	1	*	*	-	1	1	*	*	-	*	*	-	-	*	-	-	*		
355	609	5	3	2	1	*	2	8	3	*	2	*	-	1	*	*	*	-	*	-		
356	1,578	16	16	7	6	3	-	37	16	1	7	*	2	8	-	1	*	-	*	*		
3561	388	8	8	2	6	*	-	9	8	*	2	-	*	6	-	*	*	-	*	*		
357	1,332	13	13	3	7	3	-	35	12	1	4	-	*	8	-	8	1	-	*	*		
3599	228	2	2	1	-	1	-	3	2	*	1	-	*	1	-	*	*	-	*	*		
36	15,108	88	87	56	13	18	1	235	74	13	46	*	16	26	4	5	3	-	1	*		
361	962	7	6	4	1	1	*	15	6	1	3	-	1	3	*	1	*	-	*	-		
362	1,273	14	14	7	3	3	-	21	13	4	7	*	1	6	3	*	*	-	-	*		
3632	1,235	11	11	6	-	5	-	17	5	1	3	-	2	1	-	*	-	-	-	-		
364	799	5	5	4	*	1	*	7	5	*	4	-	2	1	-	1	*	-	-	*		
3643	278	2	2	2	*	-	*	2	2	*	1	-	*	*	-	*	*	-	-	*		
366	5,687	18	18	9	6	3	-	77	17	2	8	-	3	7	*	*	2	-	1	*		
367	1,688	11	11	8	1	1	-	56	10	3	6	*	3	3	1	1	*	-	*	*		
3679	678	4	4	2	1	1	-	7	4	1	2	*	1	1	*	*	*	-	*	*		
37	44,959	238	187	97	71	18	52	643	229	23	75	*	22	148	2	76	5	-	3	*		
371	31,975	124	124	63	52	9	*	417	119	15	55	*	16	64	2	53	*	-	*	*		
3717	31,646	123	122	62	52	8	*	390	117	15	53	*	15	64	2	53	*	-	*	*		
372	10,966	93	51	27	16	9	41	200	89	7	14	*	5	70	*	21	4	-	3	*		

Table 3B.--NON-APPALACHIA--WATER INTAKE BY SOURCE, GROSS WATER USED, AND TREATED AND DISCHARGED BY DISCHARGE POINT, BY INDUSTRY GROUPS AND INDUSTRIES: 1964--Con.

(In billion gallons except value)

Code	Value of shipments ($ millions)	Water intake by source						Gross water used, including recirculation or reuse	Water treated and discharged												
		Total	Fresh water				Brackish water		Total discharged	Amount treated prior to discharge	Point of discharge										
			Total	From public water systems	From company water systems						Public utility sewer			Surface water body			Ground (wells, spray, etc.)			Transferred to other users
					Surface	Ground					Total	All treated	Part treated	Total	All treated	Part treated	Total	All treated	Part treated	
3679.....	678	4	4	2	1	1	-	7	4	1	2	*	1	1	*	*	*	-	*	*
37.....	44,959	238	187	97	71	18	52	643	229	23	75	*	22	148	2	76	5	-	3	*
371.....	31,975	124	124	63	52	9	*	417	119	15	55	*	16	64	2	53	*	-	*	*
3717.....	31,646	123	122	62	52	8	*	390	117	15	53	*	15	64	2	53	*	-	*	*
372.....	10,966	93	51	27	16	9	41	200	89	7	14	*	5	70	*	21	4	-	3	*
374.....	698	5	5	2	3	*	*	6	5	*	4	-	1	1	-	*	*	-	-	-
3751.....	127	1	1	1	-	*	-	2	1	*	1	-	1	*	-	*	*	-	-	-
38.....	2,879	26	26	10	12	3	*	68	24	9	10	-	1	14	7	*	1	-	*	-
3811.....	237	1	1	1	*	*	-	2	1	*	*	-	*	*	-	-	*	-	-	-
387.....	275	1	1	1	*	*	-	3	1	*	1	-	*	*	-	*	-	-	-	-
3871.....	275	1	1	1	*	*	-	3	1	*	1	-	*	*	-	*	-	-	-	-
39.....	821	12	12	4	6	2	-	21	11	*	3	*	*	7	*	1	*	-	*	*
398.....	242	2	2	1	1	1	-	9	2	*	1	-	*	1	-	*	-	-	-	-

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

* Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 3C.--WATER INTAKE BY SOURCE, GROSS WATER USED, AND TREATED AND DISCHARGED WATER BY DISCHARGE POINT, FOR APPALACHIA, BY STATES AND MAJOR INDUSTRY GROUPS: 1964

(In billion gallons except value)

State and Major Industry Group	Code	Value of shipments ($millions)	Water intake by source: Total	Water intake by source: Fresh water: Total	Water intake by source: Fresh water: From public water systems	Water intake by source: Fresh water: From company water systems: Surface	Water intake by source: Fresh water: From company water systems: Ground	Water intake by source: Brackish water	Gross water used, including recirculation or reuse	Water treated and discharged: Total discharge	Water treated and discharged: Amount treated prior to discharge	Point of discharge: Public utility sewer: Total	Point of discharge: Public utility sewer: All treated	Point of discharge: Public utility sewer: Part treated	Point of discharge: Surface water body: Total	Point of discharge: Surface water body: All treated	Point of discharge: Surface water body: Part treated	Point of discharge: Ground (wells, spray, etc.): Total	Point of discharge: Ground (wells, spray, etc.): All treated	Point of discharge: Ground (wells, spray, etc.): Part treated	Point of discharge: Transferred to other users
APPALACHIA TOTAL.....		20,947	2,686	2,678	132	2,438	108	8	4,468	2,546	458	128	7	65	2,398	9	1,670	17	-	7	4
NEW YORK.....		1,142	28	28	6	11	11	-	39	27	5	8	*	*	19	*	5	1	-	*	1
	20	122	2	2	1	*	1	-	3	3	*	1	*	-	1	*	*	*	-	*	*
	28	104	11	11	*	10	1	-	13	11	2	*	-	*	11	-	3	*	-	-	-
	33	51	2	2	1	-	1	-	6	1	*	1	-	-	*	-	-	-	-	-	-
	34	29	*	*	*	-	*	-	*	*	-	*	-	-	*	-	-	*	-	-	-
	36	260	1	1	1	-	1	-	2	1	1	1	-	*	1	*	1	*	-	-	-
PENNSYLVANIA.....		7,724	1,035	1,032	49	954	30	3	1,892	982	159	38	2	24	936	1	649	7	-	1	*
	20	364	3	3	2	*	1	-	7	3	1	1	*	1	1	*	*	*	-	-	-
	22	96	1	1	1	*	*	-	1	1	*	1	-	-	*	-	*	*	-	*	-
	26	157	56	56	3	49	3	-	565	47	18	2	2	*	45	*	43	*	-	*	-
	28	328	102	102	6	92	4	-	137	100	4	3	-	*	94	*	19	3	-	-	*
	29	143	12	12	*	6	5	-	27	11	3	*	-	*	11	*	9	*	-	*	-
	30	90	2	2	1	1	*	-	3	2	*	1	-	*	1	-	*	*	-	-	*
	31	19	1	1	*	1	*	-	1	1	*	*	-	-	1	*	-	*	-	-	-
	32	352	11	11	2	6	3	*	16	10	1	1	*	*	8	-	3	1	-	-	*
	33	4,278	821	821	20	789	11	*	1,088	783	131	23	*	19	758	-	571	2	-	1	*
	34	370	3	3	2	*	1	-	3	3	*	1	-	*	1	-	*	*	-	-	*
	35	286	2	2	1	*	1	1	4	2	*	1	-	*	1	*	*	1	-	*	-
	36	661	12	12	4	8	*	*	20	12	*	1	-	*	11	*	1	*	-	-	*
	37	455	7	5	4	*	*	2	16	6	*	3	-	3	3	-	2	-	-	-	-
	38	76	*	*	*	-	-	-	*	*	*	*	-	*	*	-	*	-	-	-	-
	39	11	*	*	*	-	-	-	*	*	*	*	-	-	*	-	-	-	-	-	-
OHIO.....		1,384	295	295	3	258	34	-	389	288	64	39	*	31	249	1	236	*	-	*	*
	20	39	1	1	*	-	*	-	1	1	*	*	*	-	*	-	*	*	-	-	*
	28	97	68	68	*	65	3	-	82	67	1	7	-	*	60	-	59	-	-	-	*
	30	47	1	1	1	-	1	-	1	1	*	*	-	-	1	-	*	*	-	-	-
	32	52	1	1	1	*	*	-	1	1	*	*	-	*	1	-	*	-	-	-	-
	33	809	206	206	1	192	13	-	230	205	60	31	*	31	174	-	166	*	-	*	*
	34	54	1	1	*	*	1	-	1	1	*	*	-	*	1	-	*	*	-	*	-
MARYLAND.....		329	47	47	3	44	*	-	58	46	11	4	-	4	40	-	36	*	-	*	2
	20	14	*	*	*	-	*	-	1	*	-	*	-	-	-	-	-	-	-	-	-
VIRGINIA.....		194	37	37	*	33	3	-	43	36	1	*	-	*	36	*	19	*	-	*	*
WEST VIRGINIA.....		2,418	678	675	13	648	14	3	817	670	62	14	4	1	654	2	472	2	-	2	*
	32	191	2	2	1	1	1	-	10	4	*	*	-	*	3	-	*	-	-	-	-
	34	94	1	1	*	*	*	-	1	1	*	*	-	*	*	*	*	*	-	-	-
NORTH CAROLINA.....		1,913	79	79	6	72	*	-	129	78	26	5	*	1	72	1	34	1	-	*	1
	20	68	1	1	1	*	*	-	1	1	*	1	-	-	*	-	-	-	-	-	-
	22	386	6	6	2	4	*	-	11	6	2	2	-	*	4	1	1	*	-	*	*
	36	145	1	1	1	*	*	-	2	1	*	1	-	*	*	*	-	-	-	-	-
SOUTH CAROLINA.....		794	10	10	6	4	*	-	44	8	2	3	*	*	5	1	1	*	-	*	-
	22	613	7	7	4	4	*	-	35	6	1	2	-	*	4	1	*	*	-	*	-
	35	62	*	*	*	-	*	-	1	*	*	*	-	*	*	-	*	-	-	-	-
GEORGIA.....		700	25	25	6	17	2	*	67	24	8	6	*	2	18	1	12	*	-	*	*
	20	79	2	1	1	*	*	*	2	2	1	1	*	-	1	-	*	*	-	-	*
	22	449	8	8	4	3	1	-	15	8	2	3	*	1	4	1	*	*	-	-	*
	28	32	3	3	*	2	1	-	6	2	*	1	-	1	1	-	1	-	-	-	-
KENTUCKY.....		321	34	32	1	31	*	2	101	31	15	*	-	*	31	-	20	-	-	-	-
TENNESSEE.....		1,790	228	228	12	209	7	-	458	212	52	7	*	-	200	-	132	5	-	3	*
	20	172	1	1	1	*	1	-	8	1	*	1	*	*	1	-	-	*	-	-	-
	22	212	8	8	2	3	3	-	12	8	3	2	-	*	2	-	2	3	-	3	*
	28	775	155	155	5	148	2	-	264	149	26	1	-	*	146	-	101	2	-	-	*
	32	62	2	2	*	2	*	-	3	1	*	*	-	-	1	-	1	*	-	*	-
	36	69	*	*	*	-	*	-	3	*	*	*	-	*	*	-	*	*	-	-	-
ALABAMA.....		2,238	190	190	29	156	6	-	432	144	54	5	*	1	139	2	55	1	-	*	*
	20	114	2	2	1	*	1	-	2	1	*	1	-	*	*	-	-	*	-	-	-
	22	283	4	4	1	2	1	-	8	3	*	*	*	-	3	-	-	-	-	-	-
	28	206	54	54	8	45	1	-	58	52	3	*	*	-	52	-	17	-	-	-	-
	32	41	1	1	*	1	*	-	2	1	*	*	-	-	1	-	-	*	-	-	-
	33	973	91	91	16	73	2	-	250	47	22	2	*	1	45	-	32	*	-	*	*

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries. - Represents zero. *Less than 500 million gallons. D Withheld to avoid disclosing figures for individual companies.

Table 4A.--APPALACHIA--WATER INTAKE BY ESTABLISHMENTS RECIRCULATING AND REUSING WATER, BY PURPOSE AND SOURCE, GROSS WATER USED, AND DISCHARGED WATER: 1964

(In billion gallons except employees)

Code	All employees (number)	Water intake by purpose						Water intake by source						Gross water used, including recirculation or reuse	Total water discharged
		All purposes		Process	Cooling and condensing		Boiler feed, sanitary service, and other uses	Total	Fresh water				Brackish water		
		Total	Treated prior to use		Steam electric power generation	Other			Total	From public water systems	From company water systems: Surface	From company water systems: Ground			
U.S. total	4,310,906	12,258	2,752	3,030	2,658	5,729	841	12,258	9,877	1,121	7,578	1,178	2,381	28,811	11,424
Appalachia total	596,931	2,439	377	467	490	1,344	138	2,439	2,433	97	2,248	88	6	4,221	2,305
20	16,862	9	2	3	*	3	2	9	9	5	*	3	-	21	8
201	4,478	2	*	2	-	*	1	2	2	2	-	1	-	3	2
202	3,895	3	*	1	*	1	1	3	3	1	*	2	-	6	3
203	3,043	2	*	1	*	1	*	2	2	1	*	*	-	3	2
208	3,530	2	1	*	*	1	*	2	2	1	*	*	-	4	1
22	82,133	28	17	17	2	5	4	28	28	9	13	6	-	75	25
221	30,697	6	3	3	2	1	1	6	6	2	3	2	-	32	5
222	18,608	2	1	1	*	*	1	2	2	2	1	*	-	14	2
223	2,293	1	1	1	-	*	*	1	1	1	1	*	-	1	1
226	6,340	7	7	6	*	*	*	7	7	1	5	*	-	8	6
227	4,472	2	1	2	-	*	*	2	2	1	1	*	-	3	2
228	5,786	2	2	2	-	*	*	2	2	1	*	*	-	5	2
25	3,293	*	*	*	-	*	*	*	*	*	-	*	-	*	*
26	22,410	206	132	111	71	15	9	206	206	6	181	19	-	917	181
262	17,972	181	118	97	66	12	7	181	181	4	166	12	-	798	160
263	2,467	17	8	10	3	3	1	17	17	1	14	2	-	106	16
28	70,094	786	58	33	52	675	26	786	781	19	743	20	4	1,055	766
281	30,602	595	25	11	37	534	14	595	592	17	563	12	3	754	578
282	33,592	178	30	19	15	132	12	178	176	1	168	7	1	285	176
289	2,128	5	2	2	-	2	*	5	5	*	4	*	-	6	4
29	3,083	21	3	1	-	18	2	21	21	*	15	5	-	75	20
291	(D)	21	3	1	-	18	2	21	21	*	15	5	-	75	20
30	14,476	45	1	3	1	40	1	45	45	3	41	1	-	86	43
307	2,116	1	*	*	*	1	*	1	1	1	*	*	-	2	1
31	4,028	4	1	3	*	*	*	4	4	*	1	3	-	4	4
32	30,590	16	4	6	1	7	1	16	16	4	10	2	-	38	17
322	13,802	2	*	1	*	1	*	2	2	2	*	*	-	10	2
324	2,049	4	*	1	1	2	*	4	4	1	3	1	-	6	7
326	3,076	*	*	*	-	*	*	*	*	*	-	*	-	*	*
329	1,401	1	*	*	*	*	*	1	1	*	*	1	-	2	1
33	193,728	1,293	156	281	353	572	87	1,293	1,293	33	1,235	25	*	1,879	1,210
331	154,837	1,251	153	276	330	562	83	1,251	1,251	26	1,209	15	-	1,789	1,170
332	12,975	3	*	1	*	1	1	3	3	2	1	1	*	8	2
335	17,029	7	1	2	-	4	2	7	7	2	1	4	-	42	7
336	1,965	*	*	*	-	*	*	*	*	*	*	*	-	*	*
34	16,789	3	*	1	*	1	1	3	3	2	*	*	-	4	2
342	1,858	*	*	*	-	*	*	*	*	*	*	-	-	1	*
343	1,385	*	*	*	-	*	*	*	*	*	*	*	-	1	*
344	2,697	*	*	*	-	*	*	*	*	*	-	-	-	1	*
345	914	*	*	*	-	*	*	*	*	*	-	*	-	*	*
346	3,125	*	*	*	-	*	*	*	*	*	-	-	-	1	*
349	5,136	1	*	*	*	*	*	1	1	*	*	*	-	1	1
35	33,841	5	1	1	*	2	2	5	4	3	*	1	1	9	5
354	6,808	2	*	*	-	1	*	2	1	1	*	*	1	3	1
356	9,172	1	*	*	-	*	*	1	1	*	*	*	-	1	1
36	51,816	14	1	2	8	3	2	14	14	5	8	*	*	27	13
364	2,234	1	*	*	-	-	*	1	1	1	-	*	-	1	1
366	13,455	1	*	*	-	*	*	1	1	1	-	-	-	4	1
367	14,066	1	*	*	-	1	*	1	1	1	-	*	-	4	1
37	31,992	7	1	3	1	1	1	7	6	5	-	1	1	18	6
371	7,686	1	*	1	*	*	*	1	1	1	-	1	-	3	1
374	12,617	2	*	*	1	1	*	2	1	1	-	*	1	10	2
38	6,984	3	*	*	*	2	*	3	3	*	*	2	-	7	2
39	522	*	*	*	-	*	*	*	*	*	-	-	-	1	*

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero

* Less than 500 million gallons

D Withheld to avoid disclosing figures for individual companies

Table 4B.--NON-APPALACHIA--WATER INTAKE BY ESTABLISHMENTS RECIRCULATING AND REUSING WATER, BY PURPOSE AND SOURCE, GROSS WATER USED, AND DISCHARGED WATER: 1964

(In billion gallons except employees)

Code	All employees (number)	Water intake by purpose						Water intake by source						Gross water used, including recirculation or reuse	Total water discharged
		All purposes		Process	Cooling and condensing		Boiler feed, sanitary service, and other uses	Total	Fresh water				Brackish water		
		Total	Treated prior to use		Steam electric power generation	Other			Total	From public water systems	From company water systems				
											Surface	Ground			
Non-Appalachia total.	3,713,975	9,818	2,375	2,563	2,168	4,385	702	9,818	7,444	1,024	5,330	1,090	2,374	24,589	9,119
20	465,196	595	93	201	44	269	80	595	523	138	177	207	72	1,103	537
201	123,487	79	17	39	2	21	17	79	79	37	3	38	*	138	75
202	50,151	32	5	6	1	14	10	32	32	15	1	15	*	70	30
203	87,108	70	12	40	1	21	8	70	66	26	3	37	3	129	66
206	24,371	198	21	82	22	84	9	198	152	6	103	44	45	368	177
208	78,058	94	15	19	6	48	21	94	90	33	24	33	3	155	81
22	149,105	67	47	45	6	8	7	67	66	16	43	6	1	183	61
221	56,743	14	11	9	1	2	2	14	14	4	10	1	*	48	12
222	18,863	4	2	2	*	1	1	4	4	3	*	*	*	9	3
223	8,764	7	5	6	*	*	1	7	7	2	4	1	-	8	7
226	22,851	29	23	22	3	2	2	29	28	2	24	2	1	36	27
227	10,357	4	2	2	1	*	*	4	4	1	1	1	-	19	3
228	10,653	4	2	2	1	*	*	4	4	1	2	1	-	7	4
242	30,047	98	7	22	55	5	16	98	79	2	66	12	19	142	78
243	11,395	10	1	2	6	1	2	10	6	2	3	1	5	17	8
25	20,993	2	*	1	*	*	1	2	2	1	-	1	-	2	1
26	205,794	1,804	827	1,189	339	167	108	1,804	1,651	221	1,095	336	152	5,048	1,707
262	97,453	910	430	602	188	59	60	910	868	102	642	124	42	2,250	861
263	52,615	552	222	323	124	77	28	552	459	50	299	110	93	1,732	519
265	14,747	4	*	1	1	1	1	4	4	1	2	1	*	11	3
28	342,004	2,270	588	218	481	1,423	148	2,270	1,255	202	785	268	1,015	5,690	2,101
281	136,939	1,721	478	130	422	1,081	88	1,721	815	141	549	126	906	4,370	1,638
282	80,928	302	63	29	38	214	21	302	272	36	198	39	29	758	284
287	8,688	94	18	31	7	34	22	94	53	2	12	40	41	205	70
289	21,374	50	13	19	3	20	8	50	47	6	14	27	3	93	39
29	108,594	1,208	164	80	84	952	92	1,208	617	106	421	90	591	5,916	1,110
291	103,574	1,199	163	76	81	950	91	1,199	609	105	416	88	591	5,904	1,103
30	163,112	83	21	14	11	46	12	83	82	21	40	21	1	215	77
307	20,435	12	5	3	*	7	2	12	12	3	4	5	-	36	11
31	11,257	6	*	5	*	*	*	6	6	3	2	1	*	9	6
32	128,815	127	21	38	47	30	12	127	113	17	72	24	13	245	104
322	39,839	8	3	3	*	4	1	8	8	4	*	4	*	31	8
324	16,210	52	5	9	29	12	3	52	42	2	33	8	10	88	37
326	8,559	1	*	1	*	*	*	1	1	1	*	*	-	5	1
329	38,871	23	5	12	1	6	3	23	20	6	6	8	3	43	19
33	523,295	3,062	530	626	1,018	1,322	96	3,062	2,635	101	2,471	63	427	4,677	2,883
331	325,677	2,639	442	548	760	1,262	69	2,639	2,354	58	2,262	34	285	3,855	2,482
332	51,038	13	1	4	*	6	3	13	13	7	4	2	-	24	11
334	1,674	1	*	1	-	1	*	1	1	1	*	*	*	3	1
335	78,471	46	9	23	8	11	5	46	44	19	17	7	3	95	43
336	11,530	4	1	2	-	2	*	4	4	3	*	1	-	16	4
34	158,245	36	3	20	*	10	6	36	36	23	7	6	*	100	32
342	46,186	9	1	6	*	2	1	9	9	8	*	1	*	23	9
343	14,502	3	1	1	*	1	1	3	3	2	*	*	-	6	3
344	25,933	10	1	6	*	4	1	10	10	3	6	1	-	32	8
345	17,699	3	*	2	*	1	1	3	3	2	*	1	-	5	3
346	18,867	4	*	2	*	1	1	4	4	3	*	1	-	25	3
349	19,548	3	1	1	*	2	1	3	3	2	-	1	-	5	3
35	377,332	121	10	18	53	35	15	121	94	30	53	11	27	247	114
353	76,574	11	6	6	*	2	3	11	11	6	3	2	-	60	10
354	30,507	2	*	1	*	1	1	2	2	2	*	*	-	3	2
356	62,166	7	1	1	*	3	2	7	7	4	*	2	-	28	6
359	10,637	2	*	1	-	1	*	2	2	1	-	1	-	3	2
36	627,176	70	12	19	7	28	16	70	70	44	10	16	1	218	57
364	29,203	4	*	2	*	2	1	4	4	3	*	1	-	6	4
366	271,218	18	2	3	5	5	4	18	18	9	6	3	-	76	17
367	97,999	10	3	3	*	4	3	10	10	8	1	1	-	55	9
37	41,988	208	28	41	10	80	77	208	158	78	65	16	50	613	200
371	484,678	105	15	26	1	15	63	105	104	48	49	7	*	398	99
374	11,819	1	*	*	-	*	*	1	1	1	-	*	-	3	1
375	5,462	1	*	1	-	*	*	1	1	1	-	*	-	1	1
38	122,836	22	11	10	3	4	4	22	22	7	12	2	*	65	20
381	10,068	1	*	*	-	*	*	1	1	*	-	*	-	1	1
387	15,842	1	*	*	*	*	1	1	1	1	*	*	-	2	1
39	25,984	9	1	4	3	1	1	9	9	3	5	1	-	17	8

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

* Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 5A.--APPALACHIA--WATER INTAKE, RECIRCULATED WATER AND PURPOSE OF RECIRCULATION BY NUMBER OF ESTABLISHMENTS, AND WATER DISCHARGED BY POINT OF DISCHARGE, BY INDUSTRY GROUPS: 1964

Code	Value added by manufacture, adjusted (million dollars)	Total water intake (billion gallons)	Establishment reporting recirculation of water						Gross water used including recirculation or reuse (billion gallons)	Water discharged					
			Total (number)	Treating water prior to recirculation or reuse (number)	Purpose of recirculation					Total (billion gallons)	Point of discharge				Treated before discharged (billion gallons)
					Process (number)	Cooling and condensing		Broiler feed, sanitary service, and other uses (number)			Public utility sewer (billion gallons)	Surface water body (billion gallons)	Ground (wells, spray, etc.) (billion gallons)	Transferred to other users (billion gallons)	
						Steam electric power generation (number)	Other (number)								
U.S. total.....	81,108	12,258	6,141	2,713	2,909	503	4,344	3,325	28,811	11,424	731	10,366	152	174	3,473
Appalachia total.	8,318	2,439	656	290	268	58	471	333	4,221	2,305	100	2,191	10	4	418
20.....	283	9	78	24	26	3	59	46	21	8	4	3	1	*	1
201.....	30	2	18	3	8	-	8	11	3	2	2	*	*	*	1
202.....	57	3	26	9	5	1	22	16	6	3	1	1	*	*	*
203.....	91	2	11	4	7	-	11	4	3	2	1	1	*	-	*
208.....	72	2	15	7	5	2	12	10	4	1	1	*	*	-	*
22.....	611	28	107	43	22	4	73	76	75	25	7	14	3	*	6
221.....	186	6	34	15	7	1	28	23	32	5	1	5	*	-	*
222.....	137	2	22	10	2	-	16	16	14	2	1	1	*	-	*
225.....	81	1	10	3	1	-	6	8	4	1	1	*	*	-	*
226.....	50	7	13	3	5	2	4	8	8	6	2	5	-	*	1
227.....	65	2	7	3	2	-	5	5	3	2	1	1	*	-	1
228.....	39	2	12	7	2	-	9	9	5	2	1	1	-	-	1
25.....	27	*	5	1	1	-	4	2	*	*	*	*	*	-	*
26.....	349	206	37	19	34	9	16	21	917	181	9	172	*	-	85
262.....	259	181	17	9	16	7	12	11	798	160	6	153	*	-	76
263.....	63	17	14	6	13	2	3	8	106	16	1	15	*	-	8
28.....	1,695	786	84	46	33	15	65	31	1,055	766	10	753	2	*	74
281.....	976	595	43	23	13	4	33	16	754	578	6	572	*	*	56
282.....	591	178	28	15	16	11	21	11	285	176	4	169	2	*	15
29.....	47	21	14	8	6	-	11	6	75	20	*	20	*	*	13
291.....	44	21	12	7	5	-	10	6	75	20	*	20	*	*	13
30.....	209	45	21	7	8	-	16	10	86	43	1	42	*	*	3
307.....	29	1	7	4	3	-	4	2	2	1	*	1	*	-	*
31.....	31	4	11	4	6	1	2	7	4	4	*	4	*	-	1
32.....	392	16	53	25	18	-	41	22	38	17	1	14	*	2	2
322.....	171	2	16	12	5	-	15	4	10	2	1	1	-	-	*
324.....	52	4	11	-	2	-	10	4	6	7	*	5	*	2	*
326.....	26	*	4	2	1	-	2	3	*	*	*	*	-	-	*
327.....	5	1	3	-	2	-	1	-	1	*	-	*	*	-	-
329.....	22	1	6	3	4	-	3	3	2	1	*	1	*	-	-
33.....	2,658	1,293	120	50	67	16	90	41	1,879	1,120	54	1,153	2	*	231
331.....	2,114	1,251	76	30	45	14	54	30	1,789	1,170	52	1,116	1	*	202
332.....	128	3	18	5	8	1	12	5	8	2	1	1	*	-	*
335.....	266	7	15	11	10	-	14	3	42	7	1	6	*	-	*
336.....	23	*	3	1	1	-	3	-	*	*	*	*	*	-	*
34.....	199	3	36	15	16	1	21	12	4	2	1	1	*	*	*
342.....	23	*	4	2	-	-	4	1	1	*	*	*	-	-	-
343.....	14	*	4	2	3	-	2	2	1	*	*	*	-	-	-
344.....	32	*	5	1	-	-	4	1	1	*	*	*	-	-	*
345.....	11	*	3	2	1	-	1	-	*	*	*	*	-	*	*
346.....	41	*	6	2	5	-	2	3	1	*	*	*	*	-	*
349.....	58	1	8	3	4	1	4	4	1	1	*	*	*	-	*
35.....	293	5	23	8	12	1	17	13	9	5	3	1	1	-	1
354.....	77	2	6	1	2	-	3	1	3	1	1	*	1	-	*
356.....	86	1	7	2	5	-	6	4	1	1	*	*	*	-	*
36.....	574	14	35	18	12	4	29	24	27	13	2	11	*	-	1
364.....	32	1	3	1	2	-	2	3	1	1	1	-	-	-	*
366.....	142	1	5	3	3	-	5	4	4	1	1	*	-	-	*
367.....	121	1	11	7	1	-	9	6	4	1	*	1	*	-	*
37.....	366	7	18	12	4	2	15	12	18	6	4	3	*	-	1
371.....	97	1	6	4	3	-	6	5	3	1	1	1	-	-	1
374.....	156	2	6	4	-	2	4	3	10	2	*	2	-	-	*
38.....	88	3	7	5	-	1	7	6	7	2	2	*	-	-	*
39.....	6	*	3	2	1	-	2	2	1	*	*	*	-	-	*

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

*Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 5B.--NON-APPALACHIA--WATER INTAKE, RECIRCULATED WATER AND PURPOSE OF RECIRCULATION BY NUMBER OF ESTABLISHMENTS, AND WATER DISCHARGED BY POINT OF DISCHARGE, BY INDUSTRY GROUPS: 1964

Code	Value added by manufacture, adjusted (million dollars)	Total water intake (billion gallons)	Establishments reporting recirculation of water						Gross water used, including recirculation or reuse (billion gallons)	Water discharged					
			Total (number)	Treating water prior to recirculation or reuse (number)	Purpose of recirculation					Total (billion gallons)	Point of discharge				Treated before discharge (billion gallons)
					Process (number)	Cooling and condensing		Boiler feed, sanitary service, and other uses (number)			Public utility sewer (billion gallons)	Surface water body (billion gallons)	Ground (wells, spray, etc.) (billion gallons)	Transferred to other users (billion gallons)	
						Steam electric power generation (number)	Other (number)								
Non-Appalachia total	72,790	9,818	5,485	2,423	2,641	445	3,873	2,992	24,589	9,119	631	8,175	142	171	3,055
20	7,838	595	1,482	515	583	63	1,054	837	1,103	537	187	266	70	13	124
201	1,275	79	248	66	80	15	168	130	138	75	55	18	1	*	35
202	714	32	334	116	68	9	270	187	70	30	20	8	2	*	3
203	1,250	70	307	87	220	3	155	149	129	66	31	26	8	1	26
206	446	198	99	38	75	8	67	71	368	177	2	110	54	11	41
208	1,847	94	216	100	72	15	175	131	155	81	43	36	2	1	7
22	1,189	67	224	83	38	15	146	152	183	61	21	39	1	*	14
221	376	14	50	24	6	3	44	25	48	12	3	8	*	*	3
222	148	4	30	12	-	2	22	23	9	3	2	1	*	*	1
225	58	2	20	5	2	-	10	12	46	2	1	*	-	-	*
226	198	29	42	12	11	6	17	34	36	27	10	17	*	*	5
227	106	4	13	7	3	2	9	9	19	3	2	1	1	-	1
228	70	4	22	8	3	-	16	16	7	4	1	3	*	-	1
242	224	98	67	27	15	27	17	52	142	78	1	73	2	1	28
243	109	10	35	15	8	9	11	27	17	8	1	6	*	*	*
25	184	2	23	7	7	3	17	17	2	1	1	*	*	-	*
26	3,253	1,804	531	248	470	115	190	325	5,048	1,707	68	1,598	10	32	593
262	1,404	910	233	115	211	47	68	149	2,250	861	36	805	1	18	273
263	1,013	552	158	71	151	49	59	102	1,732	519	20	481	8	10	230
265	186	4	22	13	12	1	16	11	11	3	1	2	*	-	2
28	9,342	2,270	709	388	308	65	588	346	5,690	2,101	88	1,922	23	69	423
281	3,535	1,721	341	196	138	29	280	159	4,370	1,638	54	1,508	12	65	296
282	1,822	302	112	66	49	16	99	57	758	284	12	264	5	3	92
287	185	94	43	11	28	3	32	13	205	70	1	69	1	*	16
29	2,860	1,208	215	153	90	15	184	156	5,916	1,110	9	1,074	5	22	919
291	2,785	1,199	185	144	71	15	172	139	5,904	1,103	7	1,070	4	22	918
30	2,117	83	184	62	87	11	155	95	215	77	20	55	1	*	6
307	238	12	52	18	17	1	45	18	36	11	5	6	*	*	3
31	103	6	29	8	10	8	9	23	9	6	4	2	*	-	4
32	2,021	127	284	116	149	21	193	97	245	104	10	90	3	1	21
322	468	8	49	27	19	1	44	16	31	8	3	4	-	1	1
324	384	52	78	21	39	13	58	18	88	37	*	36	1	*	2
326	79	1	13	5	6	1	7	9	5	1	*	*	-	-	*
327	145	6	47	16	26	-	19	12	14	4	*	3	1	*	1
329	611	23	70	32	41	3	48	32	43	19	5	12	1	*	10
33	7,685	3,062	460	192	279	35	333	184	4,677	2,883	67	2,768	17	31	862
331	5,068	2,639	161	71	100	13	123	59	3,855	2,482	37	2,426	15	4	836
332	547	13	63	27	27	2	47	20	24	11	5	6	*	*	3
334	18	1	8	1	4	-	7	3	3	1	1	-	-	-	-
335	976	46	114	44	86	3	83	48	95	43	14	26	1	2	5
336	126	4	24	13	13	-	16	8	16	4	3	1	*	*	*
34	1,971	36	229	84	128	7	151	121	100	32	20	12	*	*	8
342	659	9	40	23	26	1	27	24	23	9	6	3	*	*	2
343	191	3	21	7	12	2	15	12	6	3	2	1	*	-	*
344	269	10	37	8	20	1	26	21	32	8	2	6	*	*	5
345	207	3	22	8	16	1	13	7	5	3	2	1	*	-	*
346	208	4	28	12	13	-	17	13	25	3	3	*	-	*	*
349	260	3	34	17	21	2	24	23	5	3	2	1	*	-	*
35	4,794	121	234	106	103	20	177	144	247	114	27	85	1	1	9
353	1,075	11	42	23	18	3	32	32	60	10	6	3	*	*	*
354	377	2	24	11	11	2	18	14	3	2	2	1	*	*	*
356	748	7	51	20	27	4	42	24	28	6	5	2	*	*	1
359	138	2	13	6	4	-	10	5	3	2	1	1	*	*	*
36	7,656	70	303	159	132	8	257	147	218	57	36	19	2	*	10
364	366	4	29	7	15	-	23	6	6	4	3	1	*	-	*
366	3,109	18	60	35	21	1	57	35	76	17	8	7	2	-	2
367	949	10	61	26	25	-	53	31	55	9	6	3	*	*	3
37	16,540	208	297	167	169	9	249	163	613	200	56	139	5	*	19
371	9,955	105	183	110	120	6	157	101	398	99	40	59	*	*	12
374	158	1	5	3	1	-	4	4	3	1	1	*	*	-	*
375	44	1	6	2	4	-	2	1	1	1	1	*	*	-	*
38	1,856	22	72	37	29	4	60	33	65	20	6	14	1	-	9
381	126	1	6	3	1	-	6	4	1	1	*	*	*	-	*
387	156	1	10	5	1	1	9	4	2	1	1	*	-	-	*
39	330	9	35	14	12	2	25	16	17	8	2	5	*	*	*
398	119	1	5	3	2	-	4	3	8	1	*	*	-	-	*

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

* Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 6A.--APPALACHIA--WATER TREATED PRIOR TO USE AND TYPE OF TREATMENT BY NUMBER OF ESTABLISHMENTS, BY INDUSTRY GROUPS AND INDUSTRIES: 1964

Code	Water treated prior to use (billion gallons)	Number of establishments treating intake water prior to use by type of treatment							
		Aeration	Coagulation	Filtration	Softening	Ion exchange	Corrosion control	Other	No treatment performed
U.S. total.....	2,932	463	1,013	1,665	3,475	1,400	2,226	590	3,533
Appalachia total.	412	52	153	220	388	127	253	61	412
20.....	2	1	8	21	42	7	28	3	62
208.....	1	-	5	11	10	4	7	1	5
2082.....	1	-	-	6	6	1	6	-	4
22.....	21	10	33	47	65	8	61	15	54
2211.....	4	2	8	13	13	2	24	6	16
2221.....	2	4	5	4	4	1	9	5	14
2231.....	1	1	2	3	2	-	2	1	-
225.....	1	-	3	3	15	3	5	1	4
226.....	7	2	8	12	13	1	5	-	9
2261.....	4	-	5	5	3	1	3	-	4
227.....	1	1	2	2	6	-	3	-	6
228.....	2	-	4	6	9	-	8	2	4
229.....	2	-	1	2	3	1	4	-	1
26.....	133	3	15	18	27	12	9	3	9
2621.....	119	2	11	11	13	8	4	2	1
28.....	76	10	40	51	67	40	36	10	33
281.....	39	9	14	25	34	18	18	4	21
2815.....	1	3	2	4	8	4	4	1	1
2818.....	15	3	5	8	10	6	6	1	6
2819.....	20	2	5	6	7	4	4	1	3
282.....	32	-	19	19	21	18	11	4	5
2821.....	4	-	4	4	9	8	4	3	5
2823.....	21	-	10	10	10	4	6	-	-
283.....	1	-	2	2	4	2	2	-	1
289.....	4	1	4	4	6	2	4	1	2
29.....	3	-	3	5	8	4	5	2	5
2911.....	3	-	3	4	8	3	5	2	2
30.....	2	3	4	5	16	3	8	-	14
31.....	1	1	4	3	7	3	1	-	9
3111.....	1	1	4	3	7	3	1	-	8
32.....	6	6	6	9	23	6	18	8	54
322.....	3	2	2	1	9	3	7	5	9
33.....	162	9	31	39	69	19	42	9	65
331.....	159	6	23	30	52	15	31	4	31
3312.....	158	4	18	25	42	13	25	3	25
333.....	2	1	4	4	3	2	2	2	1
335.....	1	1	3	3	6	2	5	3	9
34.....	1	4	1	3	19	-	14	4	37
344.....	1	-	-	-	5	-	4	2	6
36.....	1	2	5	6	14	17	11	2	31
37.....	1	3	2	4	10	2	8	-	8

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

* Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 6B.--NON-APPALACHIA--WATER TREATED PRIOR TO USE AND TYPE OF TREATMENT BY NUMBER OF ESTABLISHMENTS, BY INDUSTRY GROUPS AND INDUSTRIES: 1964

Code	Water treated prior to use (billion gallons)	Number of establishments treating intake water prior to use by type of treatment							
		Aeration	Coagulation	Filtration	Softening	Ion exchange	Corrosion control	Other	No treatment performed
Non-Appalachia total.....	2,520	411	860	1,445	3,087	1,273	1,973	529	3,121
20.....	111	81	181	311	838	198	452	123	976
2021.....	1	-	-	2	19	5	10	1	38
2046.....	10	2	8	11	8	7	1	1	5
206.....	29	2	11	16	37	16	9	19	59
2061.....	4	1	5	8	12	1	4	4	29
2062.....	3	1	6	8	12	3	5	1	3
2063.....	22	-	-	-	13	12	-	14	27
208.....	17	7	93	149	112	45	58	31	73
2082.....	9	4	6	46	53	18	45	12	23
2095.....	1	1	-	4	11	1	2	-	1
22.....	69	17	83	144	165	26	105	24	137
2211.....	14	3	24	28	25	3	16	10	26
2221.....	3	-	5	11	13	4	19	2	10
2231.....	10	5	15	19	18	4	17	3	18
225.....	3	2	3	12	23	1	5	-	19
226.....	32	4	19	40	41	9	20	6	31
2261.....	23	4	13	20	18	2	12	5	13
227.....	2	1	5	9	9	1	5	1	5
228.....	3	1	9	12	14	1	10	1	5
229.....	1	1	3	12	19	2	12	1	22
243.....	2	5	4	4	11	3	14	2	23
2432.....	1	4	3	4	9	3	13	2	21
26.....	854	34	185	274	254	134	133	45	134
2621.....	454	14	99	154	90	60	46	21	45
28.....	623	77	137	219	473	313	293	89	261
281.....	503	37	80	112	219	147	144	44	132
2815.....	40	3	8	14	24	13	13	7	10
2818.....	333	19	34	41	71	48	48	12	29
2819.....	75	12	28	39	94	70	58	17	33
282.....	73	13	34	50	81	71	59	14	24
2821.....	34	8	18	27	52	43	40	11	23
2823.....	12	1	4	5	2	3	2	1	-
283.....	6	8	3	16	42	42	25	16	7
289.....	14	9	13	20	44	14	23	4	39
29.....	166	26	74	89	164	100	128	36	43
2911.....	165	26	72	86	150	93	123	36	14
30.....	23	18	13	44	95	35	72	16	90
31.....	1	3	2	7	17	3	9	1	41
3111.....	1	3	2	7	16	3	9	1	39
32.....	44	11	21	33	122	45	70	30	261
322.....	4	2	2	3	41	13	24	6	20
33.....	537	31	56	95	240	86	158	38	274
331.....	443	15	34	55	103	30	56	11	58
3312.....	440	8	28	45	75	25	33	10	29
333.....	81	4	9	16	32	14	22	7	21
3331.....	3	1	2	2	13	3	10	1	5
335.....	9	5	6	10	43	24	37	11	68
34.....	5	13	14	21	119	46	75	22	227
344.....	1	-	5	6	17	8	14	5	32
3461.....	1	5	1	4	21	7	9	3	24
349.....	1	1	3	-	14	4	15	4	31
35.....	11	16	18	38	147	43	103	23	161
351.....	1	2	2	6	19	8	11	2	10
3522.....	1	2	4	8	20	5	11	3	14
356.....	1	3	1	6	27	8	23	4	36
36.....	14	20	20	56	146	106	114	29	173
3632.....	1	-	-	2	5	3	2	1	9
37.....	30	25	24	50	162	75	130	24	153

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero

* Less than 500 million gallons

D Withheld to avoid disclosing figures for individual companies.

Table 6C.--WATER TREATED PRIOR TO USE AND TYPE OF TREATMENT BY NUMBER OF ESTABLISHMENTS, FOR APPALACHIA, BY STATES AND MAJOR INDUSTRY GROUPS: 1964

State and major industry groups	Code	Water treated prior to use (billion gallons)	Number of establishments treating intake water prior to use by type of treatment							
			Aeration	Coagulation	Filtration	Softening	Ion exchange	Corrosion control	Other	No treatment performed
Appalachia total.		412	52	153	220	388	127	253	61	412
New York.....		5	1	4	9	33	11	14	4	30
Pennsylvania.....		179	18	33	69	140	39	79	16	148
	20	1	1	2	11	13	2	9	-	16
	26	26	-	4	4	7	3	1	-	3
	28	3	1	4	7	15	2	5	1	9
	29	1	-	2	4	7	3	3	1	2
	32	2	2	1	3	9	3	8	6	23
	33	142	6	15	22	45	11	22	3	33
	35	1	-	-	4	5	1	5	1	7
	37	1	3	-	2	6	1	5	-	4
Ohio.....		23	5	10	12	34	8	23	4	27
	28	2	-	2	4	6	2	1	-	2
	33	6	-	5	4	9	3	9	3	4
Maryland.....		11	1	3	7	7	3	8	-	3
Virginia.....		2	1	6	8	5	5	3	2	3
West Virginia....		31	10	21	27	39	19	21	5	28
	28	23	6	12	18	19	16	11	3	7
North Carolina...		35	2	13	16	19	9	15	7	23
	22	4	2	7	10	14	1	7	2	12
South Carolina...		4	5	8	10	10	3	20	4	32
	22	4	4	6	8	7	1	14	4	24
Georgia.....		13	1	9	14	21	1	13	3	21
	22	4	1	5	10	15	-	9	1	12
Kentucky.....		4	2	5	5	8	4	4	-	5
Tennessee.....		63	4	22	26	43	17	22	5	34
	22	4	2	4	5	15	3	7	1	-
	28	34	1	10	10	10	7	10	2	4
Alabama.....		42	2	19	17	29	8	31	11	58
	22	3	-	9	9	10	-	19	6	2
	33	5	1	3	2	6	2	3	2	16

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

* Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 7A.--APPALACHIA-WATER TREATED PRIOR TO RECIRCULATION OR REUSE AND TYPE OF TREATMENT BY NUMBER OF ESTABLISHMENTS, BY INDUSTRY GROUPS AND INDUSTRIES: 1964

Code	Gross water used including recirculation or reuse (billion gallons)	Number of establishments treating intake water prior to use by type of treatment							
		Aeration	Coagulation	Filtration	Softening	Ion exchange	Corrosion control	Other	No treatment performed
U.S. Total.....	28,811	355	256	494	819	255	1,700	1,700	6,071
Appalachia total.	4,221	43	25	43	82	21	191	191	705
20.....	21	1	1	4	8	-	21	21	102
201.....	3	-	-	1	-	-	4	4	26
2011.....	1	-	-	-	-	-	2	2	7
202.....	6	-	-	-	4	-	8	8	31
2026.....	4	-	-	-	3	-	8	8	19
203.....	3	-	-	-	-	-	3	3	13
2033.....	2	-	-	-	-	-	2	2	8
2037.....	1	-	-	-	-	-	1	1	2
208.....	4	1	-	3	4	-	4	4	17
2082.....	3	1	-	2	3	-	3	3	6
22.....	75	6	2	3	11	-	32	32	129
2211.....	32	1	-	2	3	-	13	13	33
2221.....	14	3	1	-	2	-	9	9	18
228.....	5	1	-	-	3	-	4	4	11
26.....	917	1	5	8	4	1	5	5	21
2621.....	798	1	3	3	3	1	3	3	8
2631.....	106	-	2	3	-	-	-	-	10
28.....	1,055	3	2	8	9	3	31	31	76
281.....	754	2	1	6	5	2	13	13	41
2815.....	24	-	-	1	1	-	2	2	7
2818.....	411	1	-	1	1	1	4	4	9
282.....	285	1	1	2	2	1	12	12	19
2821.....	62	1	-	1	1	-	6	6	9
283.....	9	-	-	-	1	-	3	3	1
29.....	75	2	-	-	1	1	7	7	9
2911.....	75	1	-	-	1	1	6	6	6
30.....	86	3	1	1	4	1	4	4	26
3079.....	2	1	-	-	2	-	3	3	12
31.....	4	1	1	3	3	-	-	-	15
3111.....	4	1	1	3	3	-	-	-	14
32.....	38	4	2	3	6	3	18	18	67
3211.....	17	-	-	1	2	1	3	3	3
322.....	10	2	1	2	3	2	9	9	10
3221.....	4	2	1	2	1	-	5	5	5
33.....	1,879	9	10	6	16	5	32	32	111
331.....	1,789	4	8	5	11	5	18	18	69
3312.....	1,559	4	7	5	9	4	14	14	53
332.....	8	3	-	-	1	-	4	4	21
3321.....	5	2	-	-	1	-	3	3	11
335.....	42	1	1	-	3	-	7	7	8
3352.....	36	-	-	-	-	-	4	4	2
34.....	4	3	-	3	5	-	7	7	51
35.....	9	1	-	-	2	-	4	4	28
351.....	1	-	-	-	-	-	1	1	2
36.....	27	4	-	2	4	1	13	13	41
367.....	4	1	-	-	2	-	6	6	12
37.....	18	3	-	1	6	4	11	11	11
371.....	3	1	-	1	2	1	4	4	5
3717.....	3	1	-	1	2	1	4	4	5
372.....	4	1	-	-	3	3	4	4	1
38.....	7	1	1	1	3	1	2	2	3

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

* Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 7B.--NON-APPALACHIA-WATER TREATED PRIOR TO RECIRCULATION OR REUSE AND TYPE OF TREATMENT BY NUMBER OF ESTABLISHMENTS, BY INDUSTRY GROUPS AND INDUSTRIES: 1964

Code	Gross water used including recirculation or reuse (billion gallons)	Number of establishments treating intake water prior to use by type of treatment							
		Aeration	Coagulation	Filtration	Softening	Ion exchange	Corrosion control	Other	No treatment performed
Non-Appalachia total.....	24,589	312	231	451	737	234	1,509	1,509	5,366
20.....	1,103	48	33	70	180	32	283	283	1,720
201.....	138	4	2	6	32	4	46	46	340
2011.....	123	3	1	5	25	4	33	33	177
202.....	70	11	1	11	44	6	79	79	394
2021.....	7	1	-	-	3	-	10	10	48
2026.....	33	6	-	8	29	3	52	52	206
203.....	129	9	2	9	16	2	31	31	346
2033.....	44	4	1	4	8	1	14	14	179
2035.....	4	-	-	-	5	1	6	6	23
2037.....	39	5	1	2	2	-	8	8	74
2046.....	71	1	4	5	4	3	2	2	9
206.....	368	5	2	1	3	2	11	11	83
2061.....	226	4	2	-	2	-	4	4	35
2062.....	64	1	-	1	1	2	2	2	13
2063.....	78	-	-	-	-	-	5	5	35
208.....	155	4	15	27	46	6	50	50	199
2082.....	85	2	8	17	25	3	37	37	57
2083.....	16	-	-	1	1	-	3	3	15
2093.....	5	1	-	-	1	1	4	4	4
22.....	183	16	6	13	25	2	62	62	338
2211.....	48	5	-	-	7	1	20	20	49
2221.....	9	1	2	2	-	-	10	10	30
228.....	7	1	-	1	2	-	6	6	22
242.....	142	4	3	7	8	-	19	19	68
243.....	17	1	1	1	2	-	9	9	36
26.....	5,048	23	58	117	50	15	72	72	337
2621.....	2,250	10	30	64	21	10	30	30	133
2631.....	1,732	8	20	32	14	2	13	13	94
2654.....	5	-	-	1	2	1	7	7	5
28.....	5,690	58	35	51	83	34	298	298	542
281.....	4,370	27	22	21	37	18	157	157	252
2815.....	251	5	4	2	2	1	20	20	20
2818.....	2,548	10	9	10	14	8	51	51	61
282.....	758	11	7	14	15	8	55	55	75
2821.....	393	10	6	12	12	6	33	33	56
283.....	105	8	1	6	11	5	30	30	25
2844.....	5	-	1	2	1	-	6	6	6
29.....	5,916	19	24	34	33	18	128	128	96
2911.....	5,904	19	23	30	29	14	124	124	56
30.....	215	6	4	14	17	10	41	41	183
3079.....	36	2	2	6	4	1	13	13	65
31.....	9	2	-	-	3	1	4	4	56
3111.....	8	2	-	-	3	1	4	4	53
32.....	245	11	8	11	44	10	55	55	332
3211.....	55	-	1	-	2	1	4	4	3
322.....	31	6	1	2	15	3	20	20	42
3221.....	10	2	-	1	8	1	13	13	27
33.....	4,677	23	21	30	70	28	110	110	427
331.....	3,855	7	10	17	22	6	39	39	125
3312.....	3,803	3	9	14	16	6	23	23	74
332.....	24	4	3	1	13	2	14	14	80
3321.....	15	1	2	1	3	-	6	6	43
3331.....	160	1	2	-	6	2	8	8	12
335.....	95	5	3	4	11	6	26	26	102
34.....	100	12	4	14	27	12	47	47	329
3421.....	2	-	-	2	-	1	1	1	2
35.....	247	17	7	14	42	10	76	76	251
351.....	57	-	-	1	3	3	9	9	20
3522.....	43	2	1	3	4	1	6	6	29
3531.....	31	3	3	5	8	1	9	9	17
3541.....	2	1	1	-	2	-	2	2	13
3599.....	3	3	-	-	3	1	3	3	10
36.....	218	16	9	18	55	24	104	104	244
3632.....	16	1	-	1	2	1	3	3	9
367.....	55	7	2	7	12	9	17	17	53
3691.....	4	-	1	-	5	1	2	2	13
37.....	613	33	14	40	62	25	129	129	219
371.....	398	22	11	30	36	13	84	84	120
3717.....	372	22	11	29	35	13	83	83	116
372.....	197	8	2	10	19	11	37	37	56
3729.....	27	-	1	5	6	4	17	17	21
38.....	65	7	2	6	12	4	24	24	50
3811.....	1	-	-	1	1	-	3	3	6
3871.....	2	2	-	1	-	-	3	3	6

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

* Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

TABLE 7C.--WATER TREATED PRIOR TO RECIRCULATION OR REUSE AND TYPE OF TREATMENT BY NUMBER OF ESTABLISHMENTS, FOR APPALACHIA, BY STATES AND MAJOR INDUSTRY GROUPS: 1964

State and major industry groups	Code	Gross water used including recirculation or reuse (billion gallons)	Number of establishments treating intake water prior to use by type of treatment							
			Aeration	Coagulation	Filtration	Softening	Ion exchange	Corrosion control	Other	No treatment performed
Appalachia total.		4,221	43	25	43	82	21	191	191	705
New York.....		25	1	2	3	7	1	11	11	13
	34	*	-	-	1	2	-	1	1	1
Pennsylvania.....		1,771	17	11	17	31	9	67	67	230
	20	7	1	-	2	4	-	10	10	23
	28	84	-	-	2	1	-	14	14	11
	29	26	1	-	-	1	-	4	4	7
	32	13	3	-	-	3	2	9	9	25
	33	1,032	4	5	5	7	3	12	12	63
	37	14	3	-	-	3	1	4	4	7
Ohio.....		376	2	1	3	10	2	17	17	49
	33	230	1	-	-	5	1	7	7	12
Maryland.....		41	-	-	2	2	2	4	4	9
West Virginia....		807	5	3	8	7	2	23	23	53
	32	10	1	1	2	1	-	3	3	7
North Carolina...		125	1	1	2	2	-	11	11	42
	22	9	1	-	1	2	-	5	5	24
South Carolina...		41	3	1	1	4	1	17	17	47
	22	33	3	1	-	3	-	12	12	35
Georgia.....		64	1	1	4	4	-	8	8	42
	22	13	1	1	2	4	-	6	6	23
Kentucky.....		101	1	2	1	1	1	4	4	9
Tennessee.....		417	3	-	2	6	1	11	11	70
	28	226	-	-	-	-	-	2	2	13
Alabama.....		412	8	3	-	7	2	16	16	87
	28	43	-	-	-	3	1	1	1	11
	33	249	2	2	-	1	-	3	3	17

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

* Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 8A.--APPALACHIA--WATER TREATED PRIOR TO DISCHARGE AND TYPE OF TREATMENT BY NUMBER OF ESTABLISHMENTS, BY INDUSTRY GROUPS AND INDUSTRIES: 1964

Code	Water treated prior to discharge (billion gallons)	Number of establishments treating water prior to discharge by type of treatment								
		Coagulation	Settling		Trickling filters	Activated sludge	Digestion	Ponds or lagoons	Other	No treatment method
			Primary	Secondary						
U.S. total.....	3,825	384	1,375	572	283	272	357	1,019	1,477	5,665
Appalachia total.....	458	48	166	72	46	44	58	141	146	621
20.....	2	3	5	2	1	2	2	8	12	101
22.....	9	2	13	7	6	7	7	17	15	130
226.....	2	-	2	-	2	1	-	4	2	23
26.....	86	7	21	4	2	2	3	10	9	11
2621.....	78	4	12	2	1	2	2	7	3	3
2631.....	8	2	5	1	1	-	-	3	5	6
28.....	98	4	35	17	10	11	15	40	36	49
281.....	75	2	15	9	6	5	4	21	18	27
2815.....	4	1	3	1	1	1	1	7	5	-
2818.....	14	-	6	4	2	3	-	5	3	7
282.....	21	2	16	7	4	5	8	15	13	7
2823.....	16	-	5	2	3	2	5	6	3	1
289.....	1	-	3	-	-	-	2	2	3	7
29.....	13	2	8	5	1	-	-	4	4	4
2911.....	13	1	6	4	-	-	-	4	4	2
30.....	3	2	3	3	1	2	2	1	2	25
32.....	5	4	11	4	4	5	1	9	10	63
33.....	237	11	39	13	10	6	13	21	22	91
331.....	209	7	30	10	4	3	10	13	15	49
3312.....	167	5	25	7	2	1	3	9	14	40
333.....	28	2	3	2	3	2	1	5	2	-
36.....	2	4	9	8	3	1	6	7	20	32

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

* Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 8B.--NON-APPALACHIA--WATER TREATED PRIOR TO DISCHARGE AND TYPE OF TREATMENT BY NUMBER OF ESTABLISHMENTS, BY INDUSTRY GROUPS AND INDUSTRIES: 1964

Code	Water treated prior to discharge (billion gallons)	Number of establishments treating water prior to discharge by type of treatment								
		Coagulation	Settling		Trickling filters	Activated sludge	Digestion	Ponds or lagoons	Other	No treatment method
			Primary	Secondary						
Total	3,367	336	1,209	500	237	228	299	878	1,331	5,044
20	156	24	201	62	45	29	43	160	336	1,632
206	55	1	19	6	-	-	2	51	22	48
2063	34	1	14	5	-	-	-	35	17	6
22	26	19	47	29	19	13	23	39	32	317
226	10	4	12	7	5	3	2	12	11	71
242	30	3	14	7	2	3	7	14	15	57
2421	30	3	14	7	2	3	7	14	14	55
26	620	53	157	35	15	16	11	112	153	257
2631	234	19	57	13	6	4	2	39	63	49
28	482	44	227	90	44	52	63	187	208	465
281	346	12	103	37	16	21	25	101	110	222
2815	44	-	15	6	2	4	-	14	18	12
2818	100	4	40	12	3	7	10	33	44	47
282	98	20	54	22	8	11	23	45	35	46
2823	6	-	-	-	-	-	2	3	1	2
289	9	4	31	14	5	3	5	18	17	49
29	993	23	137	73	13	19	13	102	80	65
2911	992	23	129	71	11	18	13	97	78	28
30	6	3	15	6	4	7	7	10	16	203
32	36	11	57	26	10	10	21	46	56	310
33	941	32	114	46	24	17	38	64	101	385
331	895	12	51	22	11	6	11	28	50	92
3312	874	9	41	19	6	4	6	19	31	53
333	24	5	18	6	6	6	14	14	15	25
3331	8	2	5	2	1	-	2	5	4	11
36	13	15	39	24	9	17	15	22	121	250
3729	1	4	8	5	4	2	5	4	15	24

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

* Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 8C.--WATER TREATED PRIOR TO DISCHARGE AND TYPE OF TREATMENT BY NUMBER OF ESTABLISHMENTS, FOR APPALACHIA, BY STATES AND MAJOR INDUSTRY GROUPS: 1964

State and major industry group	Code	Water treated prior to discharge (billion gallons)	Number of establishments treating water prior to discharge by type of treatment								
			Coagulation	Settling		Trickling filters	Activated sludge	Digestion	Ponds or lagoons	Other	No treatment method
				Primary	Secondary						
Appalachia total.		458	48	166	72	46	44	58	141	146	621
New York.....		5	1	6	3	2	1	2	10	11	55
Pennsylvania.....		159	26	61	30	16	13	11	36	52	206
	26	18	4	8	1	-	1	1	4	3	1
	28	4	2	7	6	2	2	3	8	10	13
	29	3	2	5	3	1	-	-	2	4	1
	33	131	5	20	6	4	2	3	8	13	48
Ohio.....		64	3	17	3	4	3	8	15	9	34
	26	3	-	5	1	-	-	-	-	2	1
	33	60	1	7	1	2	2	5	6	1	8
Maryland.....		11	2	5	2	1	2	2	3	1	8
West Virginia....		62	2	23	8	6	8	5	20	18	40
	28	56	1	17	8	4	5	4	15	14	4
North Carolina...		26	-	8	4	2	2	3	8	11	35
	22	2	-	2	1	1	2	-	4	4	22
South Carolina...		2	3	5	3	1	2	2	12	4	45
Georgia.....		8	-	5	2	2	2	5	6	9	37
Kentucky.....		15	2	5	2	-	-	1	4	1	7
Tennessee.....		52	1	13	5	5	4	6	12	16	57
	28	26	-	5	1	2	1	4	5	5	7
Alabama.....		54	8	13	8	6	6	9	10	9	91

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

* Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 9A.--APPALACHIA WATER INTAKE BY PURPOSE, GROSS WATER USED, AND WATER TREATED AND DISCHARGED, BY POINT OF DISCHARGE, BY INDUSTRY GROUP AND INDUSTRY TO ESTABLISHMENTS TREATING WATER: 1964

(In billion gallons except employees)

Code	All employees (number)	Water intake by purpose					Gross water used, including recirculation or reuse	Water discharged and treated										
									Point of discharge									
				Cooling and condensing					Public utility sewer			Surface water body			Ground (wells, spray, etc.)			Discharge point not specified
		Total	Process	Steam electric power generation	Other	Boiler feed, sanitary service, and other uses		Total	Total	All treated	Part treated	Total	All treated	Part treated	Total	All treated	Part treated	
U.S. total.....	3,131,402	9,436	2,268	1,756	4,790	622	22,398	8,870	387	31	271	8,275	389	6,179	111	*	83	98
Appalachia total....	395,239	2,099	404	420	1,164	112	3,616	2,000	78	7	65	1,911	9	1,670	10	-	7	1
20.....	6,366	4	1	*	1	1	5	3	1	1	1	2	*	1	*	-	*	*
201.....	1,130	1	*	-	*	*	1	1	*	*	*	*	-	*	*	-	-	*
202.....	950	1	*	*	1	*	3	1	*	*	*	1	*	1	*	-	*	*
203.....	2,011	1	1	*	*	*	1	1	*	*	*	1	*	*	*	-	-	-
22.....	29,421	15	9	*	4	2	22	14	3	*	1	8	2	3	3	-	3	*
221.....	7,814	1	1	*	*	*	1	1	1	*	*	*	-	*	*	-	*	-
222.....	8,433	2	1	-	*	*	5	1	*	*	*	1	1	-	-	-	-	-
225.....	1,503	1	1	-	*	*	1	1	*	-	*	*	-	*	*	-	*	-
226.....	2,587	3	3	-	*	*	4	3	*	-	*	3	1	1	*	-	*	*
227.....	2,330	1	1	-	*	*	1	1	1	-	*	1	1	*	-	-	-	-
26.....	20,451	189	100	68	14	7	855	167	7	2	4	160	2	133	*	-	*	-
262.....	16,792	168	88	63	11	6	742	149	6	2	4	143	1	117	*	-	*	-
263.....	1,999	15	8	3	3	1	101	15	1	*	*	13	*	12	*	-	-	-
28.....	58,918	749	34	46	647	22	1,001	730	7	4	3	719	2	594	4	-	2	*
281.....	23,569	587	10	37	529	11	731	570	5	4	1	565	2	441	*	-	*	*
282.....	30,204	133	21	9	93	10	238	131	2	-	1	125	*	125	4	-	2	-
29.....	3,168	21	1	-	18	2	75	20	*	-	*	20	2	9	*	-	*	*
291.....	2,929	21	1	-	18	2	75	20	*	-	*	20	2	9	*	-	*	*
30.....	5,906	6	1	-	5	*	40	6	*	-	*	6	-	6	-	-	-	-
31.....	1,220	1	1	*	*	*	1	1	*	-	-	*	*	-	*	-	-	-
311.....	1,220	1	1	*	*	*	1	1	*	-	-	*	*	-	*	-	-	-
32.....	20,963	11	4	*	5	2	19	9	1	*	1	8	-	5	*	-	*	*
322.....	11,355	4	1	*	2	1	11	4	1	*	1	3	-	*	*	-	-	*
33.....	147,142	1,089	246	304	466	73	1,551	1,035	52	*	51	981	-	914	1	-	1	*
331.....	124,987	1,051	242	281	457	70	1,476	999	52	*	50	946	-	906	1	-	1	*
332.....	2,708	1	*	-	1	*	1	1	*	*	*	1	-	1	*	-	*	-
335.....	11,421	5	2	-	2	1	34	4	*	-	*	4	-	4	*	-	*	-
34.....	7,180	1	1	*	*	*	2	1	*	-	*	1	*	1	*	-	*	*
344.....	2,317	1	*	*	*	*	1	1	*	-	*	*	*	*	-	-	-	-
35.....	11,039	2	1	-	1	*	4	2	*	*	*	1	*	1	1	-	*	-
36.....	47,145	5	2	*	2	1	16	4	1	-	1	3	*	2	*	-	*	-
362.....	4,380	1	*	*	*	*	4	1	*	-	*	1	*	1	-	-	-	-
366.....	17,798	1	*	-	*	*	5	1	1	-	*	*	*	*	-	-	-	-
367.....	12,645	2	1	-	1	*	4	2	*	-	*	2	-	1	*	-	*	-
37.....	19,808	6	3	1	1	1	16	6	3	*	3	2	-	2	*	-	*	-
371.....	7,544	1	1	*	*	*	3	1	1	-	*	1	-	1	-	-	-	-
38.....	2,528	1	*	-	*	*	3	*	*	-	*	*	-	*	-	-	-	-

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

*Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

Table 9B.--NON APPALACHIA WATER INTAKE BY PURPOSE, GROSS WATER USED, AND WATER TREATED AND DISCHARGED, BY POINT OF DISCHARGE, BY INDUSTRY GROUP AND INDUSTRY: 1964

(In billion gallons except employees)

Code	All employees (number)	Water intake by purpose					Gross water used, including recirculation or reuse	Total	Water discharged and treated									
				Cooling and condensing					Point of discharge									
									Public utility sewer			Surface water body			Ground (wells, spray, etc.)			Discharge point not specified
		Total	Process	Steam electric power generation	Other	Boiler feed, sanitary service, and other uses			Total	All treated	Part treated	Total	All treated	Part treated	Total	All treated	Part treated	
Total	2,736,163	7.337	1,864	1,336	3,626	511	18,782	6,870	309	24	206	6,364	380	4,509	101	*	76	96
20	200,689	319	117	27	142	33	503	288	74	14	35	176	10	103	34	*	28	4
201	78,605	58	26	2	16	14	99	55	36	12	14	17	*	12	1	-	1	*
202	7,250	15	6	2	5	2	31	14	9	*	3	5	*	3	1	-	*	*
203	57,551	50	26	1	19	5	74	48	13	1	5	26	2	14	8	*	5	1
204	13,309	27	3	5	16	3	41	25	4	*	3	21	*	17	*	-	*	-
206	13,272	113	49	12	49	3	167	99	1	-	1	72	7	34	24	-	21	3
22	85,881	39	28	2	4	5	68	36	7	2	3	27	6	5	1	-	1	*
221	38,353	9	6	*	1	2	17	8	3	1	*	5	2	1	*	-	-	*
222	6,519	2	1	-	1	*	2	2	1	-	1	1	*	*	*	-	*	-
225	4,042	1	1	-	*	*	2	1	*	-	*	1	*	*	-	-	-	-
226	14,232	16	13	1	*	2	19	15	1	*	1	13	3	*	1	-	*	*
227	4,546	2	1	*	*	*	15	2	1	-	*	1	*	1	1	-	-	-
242	19,846	69	21	35	3	10	100	61	1	*	1	59	2	34	*	-	*	1
243	4,345	4	*	2	1	1	5	3	1	*	1	2	*	2	*	-	*	*
26	134,743	1,272	825	242	122	82	3,677	1,236	29	2	11	1,172	43	814	5	-	5	29
261	7,339	164	132	7	18	7	555	162	1	-	1	158	1	102	*	-	*	3
262	69,967	643	398	151	44	50	1,637	634	17	-	6	598	31	458	1	-	1	17
263	39,353	429	275	75	58	21	1,383	412	9	2	4	389	8	235	4	-	4	10
265	4,579	3	1	1	1	*	5	2	1	-	*	2	-	1	*	-	*	-
28	262,352	1,419	165	167	969	118	3,694	1,298	58	3	46	1,206	12	923	26	-	19	8
281	109,158	998	94	122	713	69	2,607	922	39	1	34	862	9	659	16	-	9	5
282	79,533	267	35	34	179	19	705	250	7	1	4	236	3	164	5	-	5	2
285	5,383	3	1	*	2	*	5	3	2	*	1	1	-	1	-	-	-	*
286	2,662	12	2	*	9	1	100	11	*	-	*	9	1	7	1	-	*	1
287	6,259	72	22	6	23	21	143	55	*	*	*	54	*	53	1	-	1	*
29	107,180	1,305	84	83	1,044	93	5,894	1,229	28	2	22	1,156	243	258	4	-	2	41
291	104,613	1,300	82	81	1,043	93	5,887	1,224	27	2	21	1,152	243	254	4	-	2	41
30	61,015	35	5	10	15	5	94	34	8	*	8	26	*	23	*	-	*	*
302	12,776	1	*	-	1	*	2	1	*	*	*	1	-	1	*	-	*	-
31	9,500	7	6	*	*	1	9	6	3	-	*	3	1	1	*	-	*	-
311	9,500	7	6	*	*	1	9	6	3	-	*	3	1	1	*	-	*	-
32	62,012	93	39	28	19	8	153	84	5	*	3	68	7	47	12	-	11	*
322	16,221	4	2	*	2	1	21	3	2	*	1	2	1	1	*	-	*	-
33	354,825	2,493	500	718	1,211	64	3,733	2,339	30	*	22	2,288	39	2,149	10	-	6	12
331	255,920	2,394	460	715	1,165	53	3,481	2,249	17	*	15	2,220	35	2,112	8	-	5	4
332	17,306	6	3	*	2	1	9	6	2	-	1	4	3	*	*	-	*	-
334	909	1	*	-	*	*	2	1	*	-	*	*	-	*	-	-	-	-
335	45,943	31	14	*	15	2	53	30	9	-	5	19	*	10	1	-	*	2
339	10,292	2	*	-	1	*	6	2	1	-	1	1	*	1	-	-	-	-
34	66,620	20	11	*	6	2	50	17	6	-	5	10	1	9	*	-	*	*
344	14,105	8	4	*	4	*	29	7	1	-	1	6	*	5	*	-	*	*
347	869	1	1	*	*	*	1	1	*	-	*	*	*	*	*	-	*	-
35	166,269	70	7	19	37	6	145	69	8	*	7	60	5	55	*	-	*	1
36	350,976	41	13	*	18	10	133	30	19	*	16	10	4	5	2	-	1	-
362	13,909	6	1	*	3	2	7	6	2	*	1	4	3	*	-	-	-	-
366	160,719	6	2	-	2	2	37	6	4	-	3	1	*	*	2	-	1	-
367	62,515	7	2	*	3	2	44	6	4	*	3	2	1	1	*	-	*	-
37	627,161	121	25	2	30	63	410	114	25	*	22	85	2	76	4	-	3	*
371	269,769	80	15	*	10	55	283	76	18	*	16	58	2	53	*	-	*	*
373	26,603	2	1	*	*	1	2	2	*	-	*	1	-	1	*	-	*	*
38	46,804	11	8	*	1	3	45	10	1	-	1	8	7	*	*	-	*	-
387	[illegible],430	1	*	-	*	*	2	1	*	-	*	*	-	*	-	-	-	-

Note: Detail figures may not add to totals because of independent rounding. The figures shown for industry groups include data for all component industries whether or not separate figures are shown for the individual industries.

- Represents zero.

* Less than 500 million gallons.

D Withheld to avoid disclosing figures for individual companies.

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